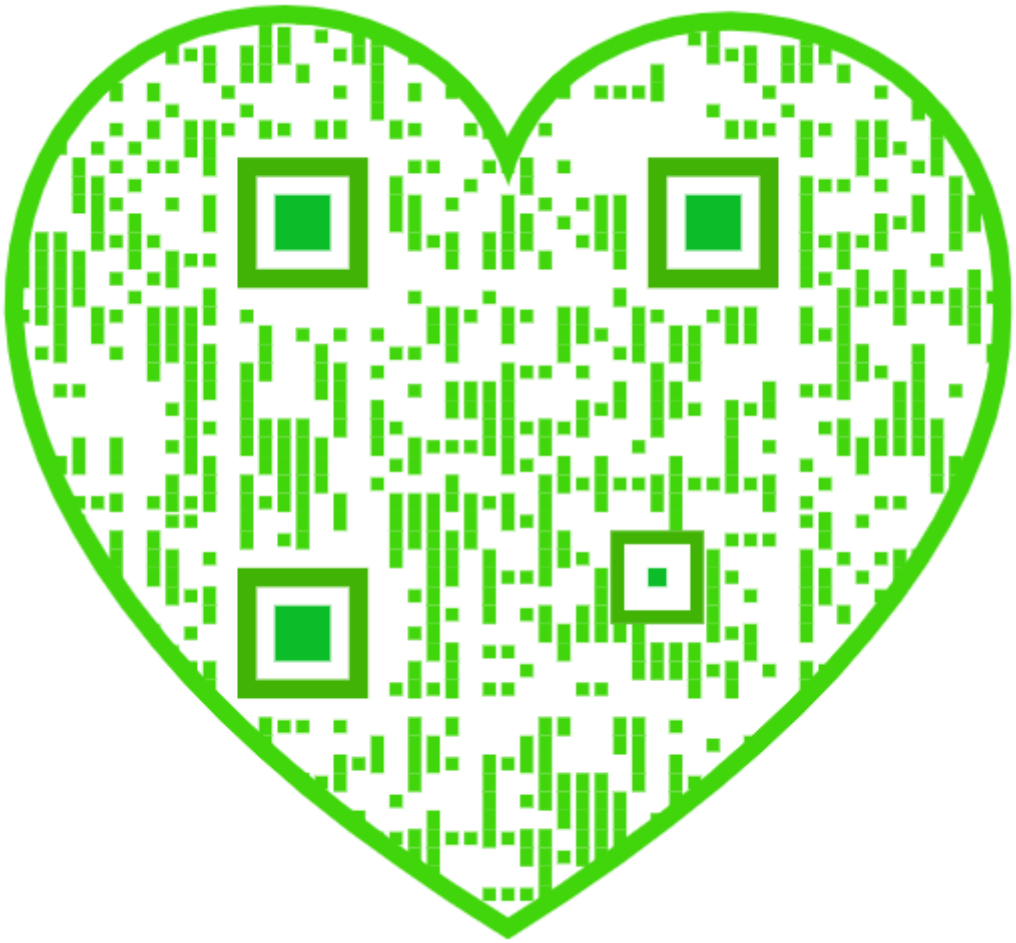

LARGER TYPES OF AMERICAN GEOGRAPHY

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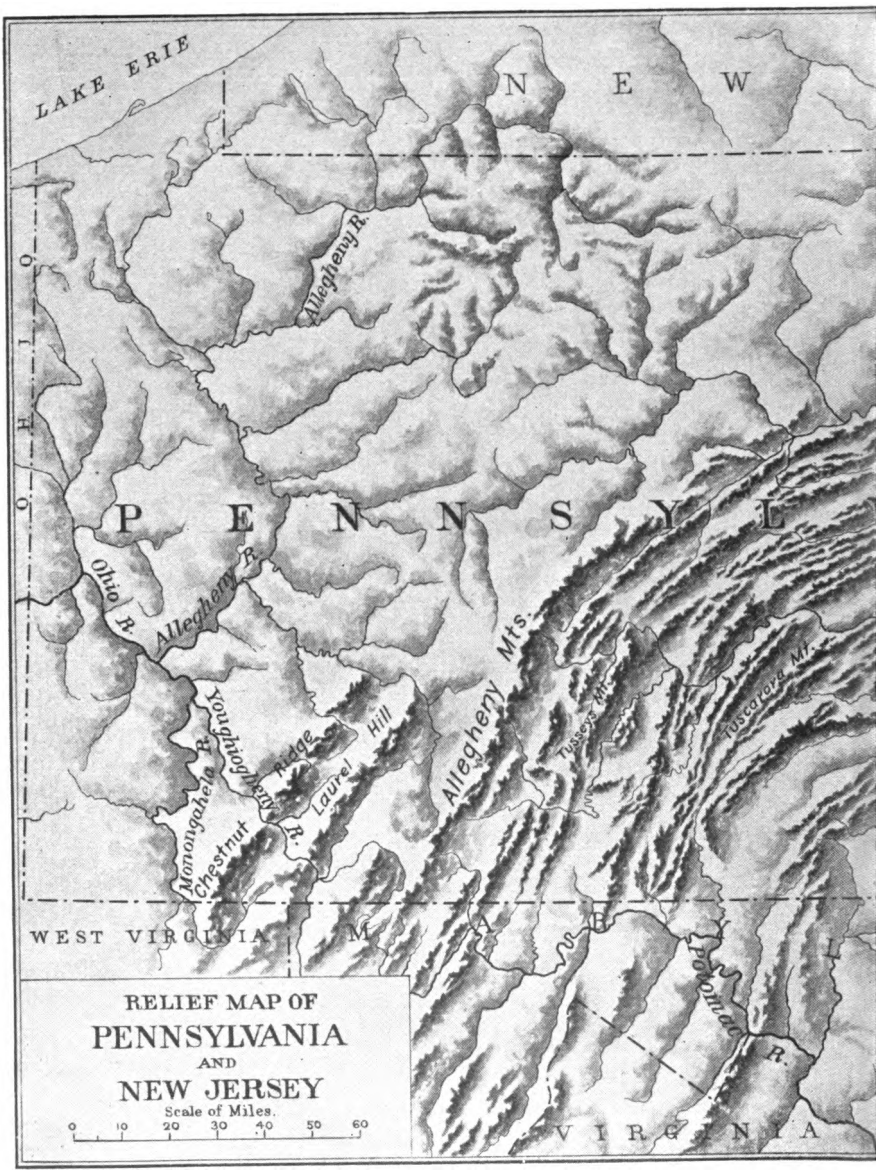
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Chestnut Ridge
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Tussey's Mt.
Tuscarora Mt.
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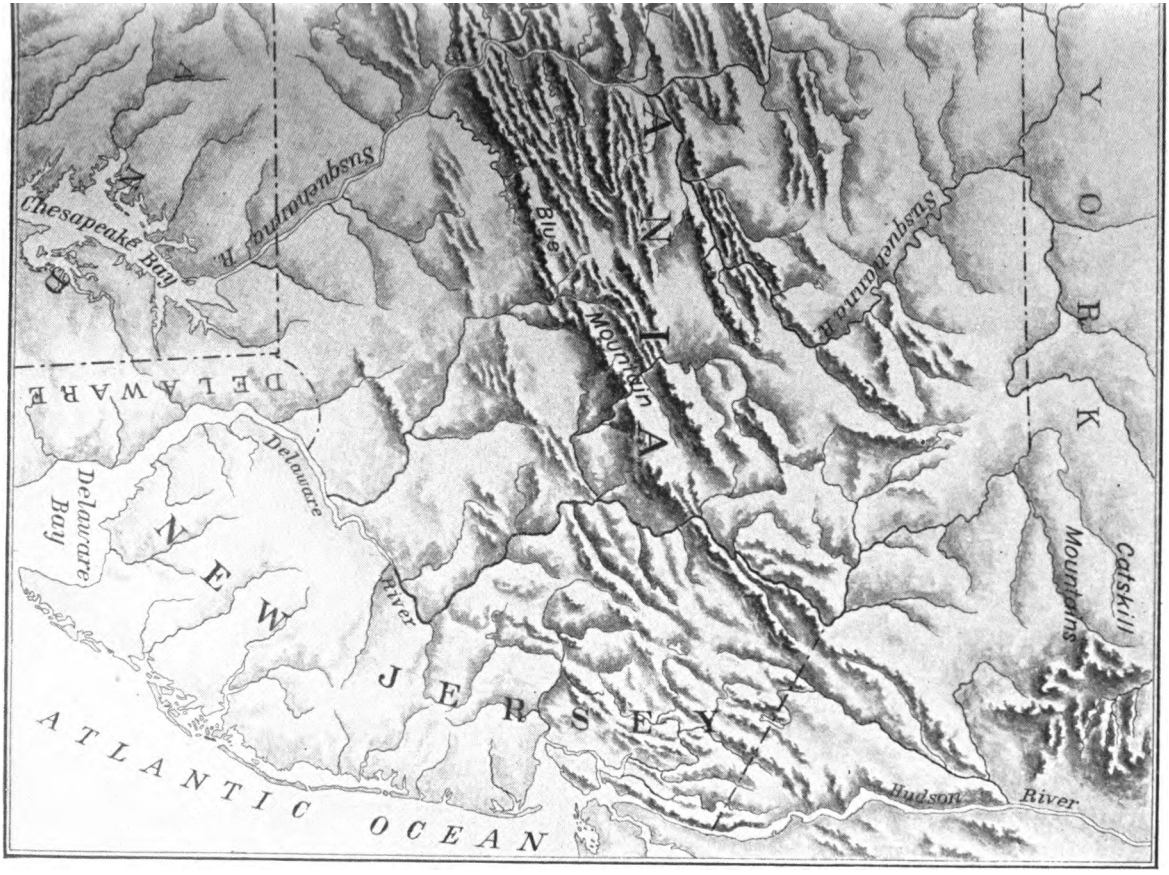
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Bay
N E W
River
J E R S E Y
ATLANTIC OCEAN
Hudson River

LARGER TYPES

OF

AMERICAN GEOGRAPHY

Second Series of Type Studies

BY

CHARLES A. McMURRY, PH.D.

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PREFACE

THIS is the third volume in a series of type studies of our own country.

The six large units worked out with some fulness of detail in the present volume furnish the broad and comprehensive framework within which to arrange and combine the lesser topics previously studied.

It is presupposed that a full and rich presentation of many smaller topics of American Geography has been provided in earlier grades as illustrated in the "Type Studies of the United States" (first series).

It is the purpose of the present book to organize these earlier studies into more comprehensive units and at the same time to bring into clear view the few commanding types which give a good survey of American Geography as a whole.

It may appear to many teachers that the treatment of single topics is far too elaborate. A moment's indulgence may be granted to the explanation of this point.

The secret of success in geographical study is found, we believe, first, in a wise selection of a few important types or units, and second, in an elaborate and fruitful treatment of these few topics. Let it be supposed that each of these topics be made the basis of a month's study

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with a full use of maps and map sketching, with a thoughtful study of the causal relation between physical and industrial conditions, with numerous reviews and comparisons with topics earlier studied, with frequent drills to fix the name and location of great physical features, traffic routes, and trade centres. In this manner each one of these great topics becomes a means of thoughtful organization, a broad survey and interpretation of many lesser facts learned before, and at the same time a complete type of those broader geographical influences which now predominate in the world.

We use the word "type" in its broad and commonly accepted meaning, as a representative object, not in a narrow or technical sense. It is this broad, general use of the term that is appropriate to the common school.

The frequent comparisons suggested and partly worked out at the end of important topics indicate a fundamental notion of method in exhibiting the character and scope of types.

Physiographic and industrial topics are both strongly represented in the types selected.

It must be confessed that these studies betray an impulse to come in close contact with the problems of our modern life, to see how men are utilizing the forces in nature and are affected in their enterprises by nature's laws and bounties. Heretofore geography has dealt with these problems at arm's length, or better expressed, at long range. Brief, general, formal descriptions have been the fashion,

and these are but the outer husk which can never satisfy an inquisitive mind.

Like the two preceding volumes of type studies, the present series is also designed to run parallel with any text-book or course of study in geography. But its materials are better suited to grammar grades (sixth, seventh, and eighth grades) than to those below.

A series of type studies on Europe of a similar character is in preparation. The general plan and course of geographical studies are outlined, explained, and illustrated in the "Special Method in Geography."

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LARGER TYPES OF AMERICAN GEOGRAPHY

LARGER TYPES OF AMERICAN GEOGRAPHY

THE APPALACHIAN MOUNTAINS

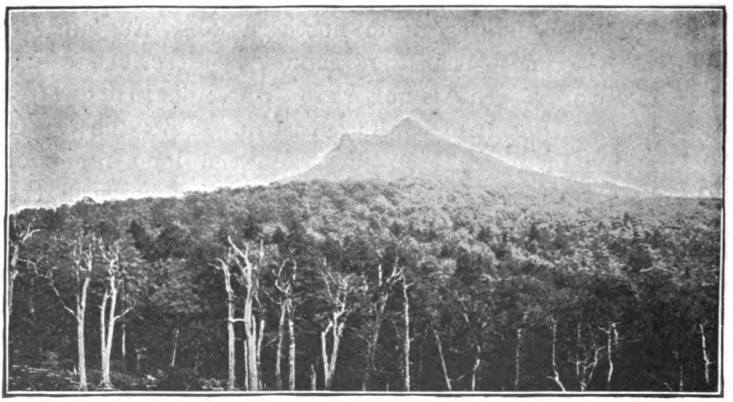
THESE mountains are so long and broad — extending through many states, from northern New England to central Alabama — that they cannot be described easily in a few words. In the north are several distinct groups, such as the Adirondacks in northern New York, the White Mountains in New Hampshire, and the long range of the Berkshire Hills and Green Mountains between the Connecticut and Hudson rivers.

The main body of the Appalachian system is not a single mountain chain, but consists of three distinct parts running parallel from the Catskills to Georgia and Alabama. In a school geography, even on the larger maps, we may scarcely detect these three divisions, and a simple description is needed that we may locate them easily on the map.

On the eastern edge of this mountain system lies the long narrow Blue Ridge, extending across Maryland and Virginia, and broadening out southward in western North Carolina into a large, lofty, irregular cluster, with the Great Smoky Mountains forming its high western ridge.

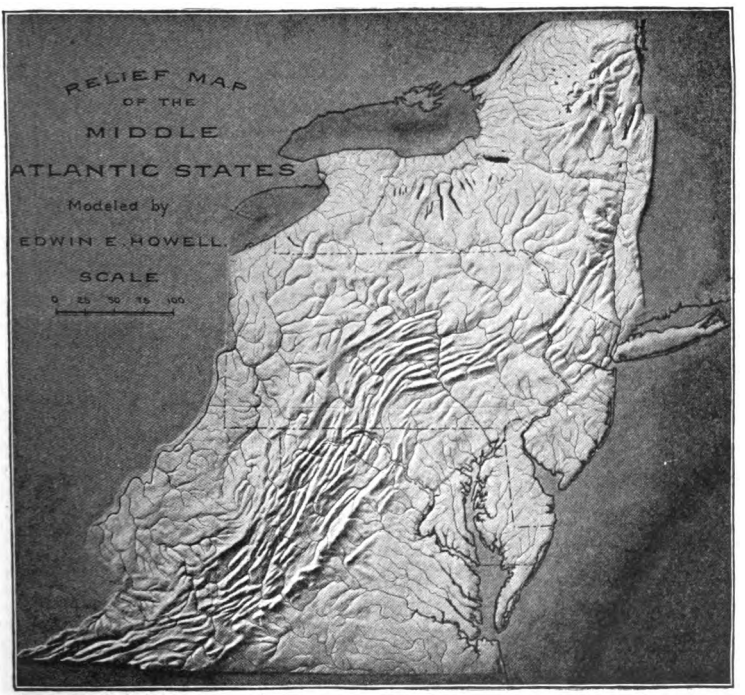
In southeastern Pennsylvania the Blue Ridge is broken down or interrupted, it being continued only in low ridges scarcely noticeable on a map. It comes to view again in northern New Jersey.

The Blue Ridge is a real mountain chain, or rather what is left of a very old mountain chain, once in the far past thousands of feet higher than now, but worn down in the lapse of ages by storm and weather, by wind and stream. As the rocks have rotted away along its sides through the course of ages, rains and streams have carried the waste to lower levels.



Grandfather Mountain, Blue Ridge of North Carolina.

The Blue Ridge, north of Carolina, is only a few miles wide, but extends hundreds of miles in length. Standing in the Piedmont uplands and looking westward toward the Blue Ridge, we can see that it is a genuine mountain chain, rising into irregular peaks and dropping down here and there into low gaps. The sky line of this ridge is thus



so broken and irregular that we cannot mistake it for the edge of a plateau.

The high confused clusters of mountains into which the Blue Ridge widens out in North Carolina are difficult to describe. Even on a large map they exhibit a criss-cross of ranges. On the east and west more continuous mountain ridges shut in a variety of upland valleys and parks which are drained chiefly by rivers cutting deep gorges through the Great Smoky range on their way to join the Tennessee.

The second strip of the Appalachian Mountain system lies just west of the Blue Ridge and is much broader. Strange to say, it is a valley, not a mountain region. In this, however, our maps usually deceive us. It is a strip of country from fifty to one hundred miles wide, usually called by geologists the "Great Valley," but on a map it looks like a series of parallel mountain ridges, more or less broken and interrupted, but extending from northeast to southwest, from New York to Birmingham. Why this is called a valley suggests a curious problem in physical geography. It is easy to see that there are many lesser valleys lying in this region, such as the Shenandoah Valley, the valley of east Tennessee, broken up into a series of parallel valleys of the Tennessee and its tributaries, the upper-stream valleys of the James and the Potomac, also the Susquehanna, in part, and its tributaries. All these valleys have the same general direction from northeast to southwest. The Great Valley might, therefore, be called a group and succession of parallel valleys with low ridges between.

One reason why this whole broad strip, with its numerous low ridges running parallel, is called a valley is that it is bounded on the east by a high chain of real mountains, the Blue Ridge, already described, and on the west by the lofty edge of a plateau which looks down upon the ridged valley from its high western level.

In fact, it is pretty certain that this region was once a broad valley, but by pressure it was crumpled into a number of billowy folds in which the earth's crust was changed from level strata to rock folds, running parallel for long distances.

The streams formed in this region naturally followed the hollows of these folds (synclines or anticlines) and washed out deeper and deeper valleys in the softer rock, leaving long narrow ridges of the harder rock. These ridges do not rise into mountain peaks, but along their upper edges are tolerably level and uniform.

These numerous parallel ridges sweep through central Pennsylvania in a great curve and then southward through Virginia and Tennessee, forming a broad belt of valleys, some of them very fruitful and well watered.

It is somewhat confusing to the valley idea, however, to find that these long parallel ridges vary greatly in height, rising sometimes to an elevation of six or eight hundred feet, as in the edge of the Tennessee Valley and in central Pennsylvania.

The contrast between this broad belt of valleys and the narrow Blue Ridge is striking. The granite rocks of the Blue Ridge are wholly different from the soft strata of limestones, sandstones, and shales in the Great Valley.

The third district is known as the *plateau region*, lying west of the Great Valley. We have seen that its eastern edge projects as a high ledge overlooking the lesser ridges in the Great Valley eastward. The presence of this high front, or escarpment, makes itself clearly manifest just west of Altoona, Pennsylvania, where the Pennsylvania Railroad was compelled to climb up the mountain side more than thirteen hundred feet, and then pierce the high front with a tunnel a mile long in order to get past this massive obstruction. In the same way the Chesapeake and Ohio Railroad, by following the valleys, climbs this escarpment and passes through a tunnel to the valley of

the Greenbriar River in West Virginia. The Catskill Mountains as seen from the Hudson River are also a part of the eastern front of this Alleghany Plateau. In fact, at this point the plateau reaches its highest elevation, some four thousand feet. But its level stratified rocks show it to be not a true mountain mass, but the edge of the plateau worn down and intersected by streams, till the ridges appear as mountain peaks.

The Cumberland Gap, on the border between Tennessee and Kentucky, is the gash in this plateau front through which the early pioneers could most easily move westward to the first settlement of Tennessee and Kentucky. Lookout Mountain, at Chattanooga, is also a part of the eastern edge of the plateau, rising to a height of seventeen hundred feet above the river. By fixing the five points above named along the line of the plateau front, on the west, and the Blue Ridge Mountains on the east, we can more easily locate the Great Valley which lies between.

The Alleghany and Cumberland plateaus on the west of the Great Valley constitute thus a very distinct and important division of the Appalachian Highlands. Here again we are deceived by appearances, for this so-called plateau resembles much more a mountainous region, with the greatest irregularities of hills and valleys, than a level plateau. To say the least, it is wonderfully rough and broken country. Even as far west as Wheeling on the Ohio, the country is almost mountainous, the bluffs and slopes along the Ohio being six and eight hundred feet high. In fact, there are a number of more or less continuous folds or ridges west of the plateau front, but most of this region has been deeply cut by the rivers

which flow westward in tortuous channels to the Ohio. It may have been once a somewhat level plateau, but no ordinary person, unskilled in geology, would imagine this or would call it less than a mountain district. It requires quite a stretch of the imagination to appreciate that the rivers, with their numerous tributary streams, working steadily for thousands and tens of thousands of years, have cut down deep, and sometimes broad, valleys, and carried off toward the sea a vast quantity of material. By the examination of a relief map of this region, one may see that it has little resemblance to the parallel ridges of the Great Valley. On the contrary, the whole broad strip is a jumble of hills, ridges, and tortuous valleys, sloping as a whole westward, but the rivers winding in all directions as they make their way to the Ohio. Some of the larger streams, like the Upper Monongahela, Kentucky, and Big Kanawha, have cut deep and picturesque gorges in their upper courses.

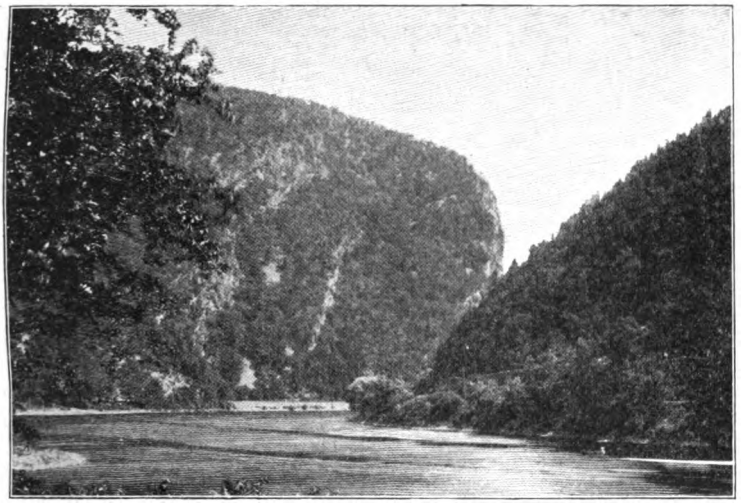
The plateau region west of the Great Valley is higher and far more irregular and mountainous than the Piedmont belt that lies east of the Blue Ridge.

An examination of the whole Appalachian region south of the Hudson, to observe the sources, direction, and course of the chief rivers forming the drainage system, brings out some curious and unexpected results. One of the chief rivers in the north is the Susquehanna. We might expect to find its source on the southeast slope of the Blue Ridge. But the Blue Ridge is largely broken down in southeastern Pennsylvania, and the river is seen coming down across the numerous ridges of the Great Valley. It even reaches back across the high escarpment and takes its rise far away

in the plateau region of central New York. It completely crosses all three mountain belts and ridges in order to reach the Chesapeake Bay and the Atlantic. Extending south from Williamsport to Harrisburg, the railroad, following the east bank of the Susquehanna River, passes through a large number of gaps which the river has cut directly across the ridges. Looking down into the river current at these gaps, one always sees the ledges of rock, the roots of the mountain, which the river is still sawing across. For the water, loaded with sand and gravel, especially in spring freshets, is grinding away at these rocks, and in winter the ice is driven across the edges, helping to wear them down. Further north, the river has cut down through the plateau, leaving a deep and imposing gorge. The Susquehanna and its tributaries furnish the railroad easy routes through the north-central part of Pennsylvania, and the southern part of New York.

A glance at the course of the Delaware shows that it also has sawed its way across the plateau and the lower valley ridges to the Atlantic. The Delaware Water Gap, where it cuts through the highest ridge, is a famous piece of scenery. South of the Susquehanna, the Potomac and the James rivers also reach back across the Blue Ridge and the Great Valley to the western plateau for their sources, and furnish the route for great railways across the mountain system. It is strange that these rivers, instead of draining the eastern slopes of the mountains, should reach clear across numerous mountain ridges and drain the other side of the mountain slope.

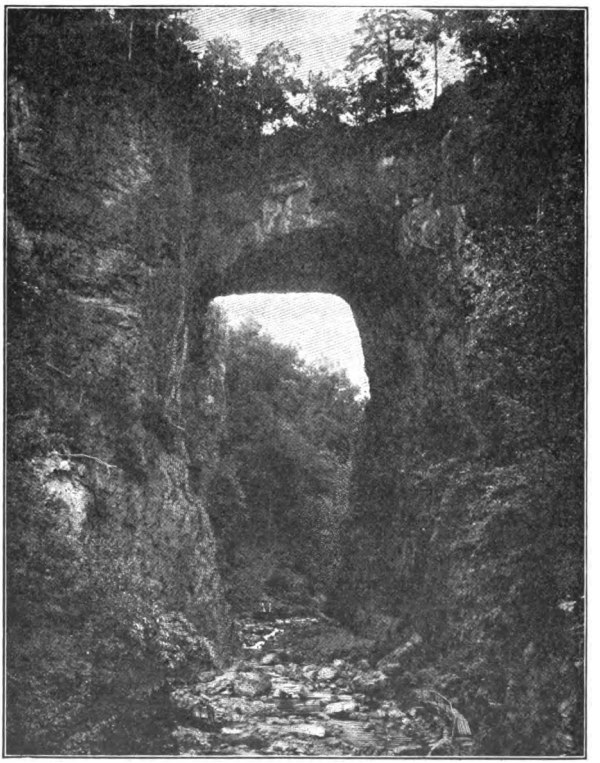
If now we turn our eyes to the southern rivers, we notice first that the Big Kanawha of West Virginia reaches back



The Delaware Water Gap.

eastward across the plateau, across the Great Valley and its many ridges, and across the Blue Ridge, and, not yet satisfied, finds its sources far to the south in the eastern slopes of the Blue Ridge Mountains of North Carolina. In other words, the Big Kanawha in the south exactly reverses the history of the Susquehanna in the north. Still more surprising is the course of the Tennessee River. Its sources are far to the east, in the maze of mountain uplands east of the Great Smokies. Having scoured deep gorges westward through this high range, the Tennessee drains southward the whole broad valley of East Tennessee, and then, instead of following its ancient course to the Gulf, it breaks through a series of lofty ridges (Lookout Mountain) forming the front of the Alleghany Plateau. It makes a

grand sweep to the southwest, and finally turns northward to the Ohio. In the northern half of the Appalachians, therefore, the chief rivers, like the Delaware, Susquehanna,



The Natural Bridge, Virginia.

and Potomac, cut clear across the whole triple mountain system, and drain their waters into the Atlantic. In the southern Appalachians, on the contrary, the western rivers

reach far eastward across plateaus, valleys, and lofty mountain ridges to the eastern limits of the Blue Ridge, and drain their waters into the Ohio.

Influence of these Mountains upon the History of the People

The Appalachian Mountains during the period of colonial history were a very difficult barrier to cross. In our present time, the means of travel across the mountains by railroads have been made so complete that many people scarcely realize that there is a rugged mountain region, three hundred miles wide, between the Mississippi valley and the Eastern states.

But in the early days of our history these mountains were practically impassable. The earliest settlers had plenty of room in the plains east of the mountains, and with the increase of population moved westward to the foot of the Blue Ridge, and even into some of the valleys beyond, as the Shenandoah in Virginia and the Cumberland in Pennsylvania. The mountains were not so very high, but they consisted of a great many parallel ridges which had to be crossed, and were covered with heavy forests and underbrush. The river valleys were naturally the easier lines of travel, but most of them extended from north to south. Where the streams occasionally broke through the ridges, forming narrow cuts, the road was not very easy. In order to find easy passage across the ridges it was often necessary to travel many miles north or south along a narrow valley in search of a gap opening into the next valley beyond. The most difficult part was the

ascent across the high front of the Alleghany Plateau, and after that came a journey of a hundred miles through a mountainous and forest-covered country to Ohio or Kentucky. Beyond the mountains were also savage Indian tribes, ready to dispute this territory with new settlers.

The early colonies remained for one hundred and fifty years on the east side of the mountains, almost entirely shut off from the valley of the Ohio, which with its branches drains all the western slopes. One result of this was a much more compact and closely populated country along the Atlantic seaboard. Without the barrier of the mountains, the people would have spread rapidly and easily westward, and scattered out far more widely, with important results to our history. There was in New York one line of advance along the Mohawk River, where was an easy passage to Lake Erie and the great Northwest. But during the colonial period this region was completely occupied by the strong confederation of the Iroquois tribes, and any passage through that region or settlement beyond it was out of the question.

But the time came about the middle of the eighteenth century when the people, having filled up the lands sloping toward the Atlantic, began to penetrate the mountains and to cast longing glances even toward the rich valleys and plains beyond the Alleghany Highlands. About this time, also, the French, who had established a series of forts along the Great Lakes and the Mississippi River, were prepared to dispute with the English settlers the possession of the Ohio Valley. In this conflict the colonial armies had to force their way across the difficult mountain region, and defeat the French forces on the

other side. The first attempts, in which Washington and Braddock figured, were failures. But the third attempt under Forbes was successful, and Fort Duquesne became Fort Pitt. It was in these military campaigns that the first roads were laid out across the mountains, one the old Braddock Road, by way of the Potomac, Fort Cumberland, and the Youghiogheny River, and the other, the road laid out by Forbes, a little farther north.

During the Revolutionary period the pioneers poured through the mountain valleys and passes to the settlement of the western lands. But only a few points offered where they could break through, and even here, with much hardship and laborious travel over rough mountain roads. There were three routes by which the pioneers could reach Pittsburg through the Pennsylvania Mountains: the old Braddock Road, the Forbes Road, south of the Juniata, and by the west fork of the Susquehanna to the Alleghany at Kittanning. But south of Pennsylvania there was no break through the mountains suitable for a road till the Cumberland Gap was reached on the northern border of Tennessee. Through this the old Wilderness Road was laid out by Boone, one branch of it leading northwest to the fine valley of the Kentucky River, and the other westward to Nashville, at the bend of the Cumberland. Climbing up through the Cumberland Gap, the pioneers, with their families, horses, and cattle, poured into the rich valleys of Tennessee and Kentucky. Even from Pennsylvania and Maryland many emigrants, the Scotch-Irish and others, passed hundreds of miles down the Great Valley and settled East Tennessee, or crossed through the Cumberland Gap to Kentucky, or to the central valley of Tennessee.

At the close of the Revolution, after the defeat of the Iroquois, the road through the Mohawk Valley westward to the Great Lakes was opened, and the tide of immigration set strongly in this direction.

In 1818 the United States government completed the National Road to the Ohio, from Cumberland over the mountains through Uniontown and Brownsville to Wheeling, West Virginia. Later it was built across Ohio, Indiana, and Illinois to St. Louis. For many years this well-built turnpike was thronged with wagons and people moving westward, or carrying the products of the West eastward. The entire road, almost eight hundred miles long, cost the government nearly $7,000,000. Famous hotels and hostelries abounded along the whole route, where food and whiskey were dealt out liberally to the throngs of travellers. It was a well-built macadam road, with stone bridges across the streams and iron toll gates about fifteen miles apart. Beginning with Jefferson's administration in 1804, it was many years building. Henry Clay was most influential in urging Congress to this great national work. Near Wheeling, West Virginia, is a monument in commemoration of Clay's efforts.

"In the year 1822, shortly after the completion of the road, a single house in the town of Wheeling unloaded 1081 wagons, averaging about 3500 pounds each, and paid for the carriage of the goods $90,000. At that time there were five other commission houses in the same place, and estimating that each of them received two-thirds the amount of goods consigned to the other there must have been nearly 5000 wagons unloaded, and nearly $400,000 paid as the cost of transportation. But further, it is esti-

mated that at least every tenth wagon passed through that place into the interior of Ohio, Indiana, etc., which would considerably swell the amount. These wagons take their return loads and carry to the Eastern markets all the various articles of production and manufacture of the West, — their flour, whiskey, hemp, tobacco, bacon, and wool. Since this estimate was made, the town of Wheeling is greatly enlarged; its population has nearly doubled; the number of its commercial establishments has greatly increased; and the demand for merchandise in the West has increased with the wealth, improvement, and prosperity of the country.

"But further, sir, before the completion of this road, from four to six weeks were usually occupied in the transportation of goods from Baltimore to the Ohio River, and the prices varied from six to ten dollars per hundred. Now they can be carried in less than half the time and at one-half the cost, and arrangements are making by some enterprising gentlemen of the West to have the speed of transportation still increased, and the price of carriage diminished.

"Equally important are the benefits derived by the government and the people from the rapid, regular, and safe transportation of the mail on this road. Before its completion, eight or more days were occupied in transporting the mail from Baltimore to Wheeling; it was then carried on horseback, and did not reach the western country by this route more than once a week. Now it is carried in comfortable stages, protected from the inclemency of the weather, in forty-eight hours; and no less than twenty-eight mails weekly and regularly pass

and repass each other on this road." (A speech made in Congress in 1832, "The Old Pike," Searight.)

Parts of this old road are now in use. Some of its old stone bridges still stand as enduring monuments.

During the first thirty years of the nineteenth century several attempts were made to build canals connecting the Atlantic rivers with the Great Lakes and the Ohio. In 1825 the Erie Canal was completed from Albany to Buffalo, and has ever been a most important factor in the East-and-West traffic. The state of Pennsylvania also built a series of canals, attempting to connect the Susquehanna with Pittsburg, but the canal along the Juniata upon reaching the great plateau front near Altoona (Hollidaysburg) could not be carried over the mountain, and a portage railroad, thirty-eight miles in length, was built across this ridge to Johnstown, where a canal and river connected this railroad with the Alleghany and Pittsburg.

In a similar manner a canal was built from Washington, D.C., upward along the Potomac to Cumberland, with the idea of connecting with the Youghiogheny and Pittsburg, but the difficulties were too great in crossing the mountains.

In the period between 1830 and 1850 the first railroads were projected and carried across the mountains. The Pennsylvania Railroad was completed from Philadelphia to Pittsburg in 1852, and thus, finally, easy railroad communication was established between the East and West. During the same period the New York Central was built, and later the Baltimore and Ohio. The latter railroad passes through seven miles of tunnels in crossing the mountains, and the Chesapeake and Ohio, which crosses

through a still more rugged region of West Virginia, has also seven miles of tunnels.

For the last one hundred and fifty years the American people have been engaged in a series of expensive enterprises, costing in all many hundred millions of dollars, in laying out traffic routes across the Appalachian Mountains, so as to connect the Atlantic states with the Mississippi Valley and the West. This road building is a part of the great westward movement of population, by which the people have spread over and possessed the continent. Beginning with Indian trails across the mountains, they passed on gradually to pioneer routes, military roads, the National Pike, canals, and, finally, to the great railroads, which give the utmost speed and comfort in travel, and provide for a vast freight traffic.

Among interesting and important events in American history, the Appalachian Mountain regions have had their full share. In early pioneer times the exploration of the mountains was full of arduous enterprise and adventure, as illustrated by the early life of Boone and Robertson in the South, of Washington and Gist in Virginia and Pennsylvania, and of Stark and others in New England. During the Revolution the battles of King's Mountain in the South and Bennington in the North gave strong proofs of the valor of the mountaineers. The old military expeditions through the mountains during the French and Indian wars and during the Revolution were of great importance and interest. During the Civil War the battle of Gettysburg, the conflicts about Chattanooga and Atlanta, and the march of armies through the Great Valley were among the most thrilling and important events of the hard struggle.

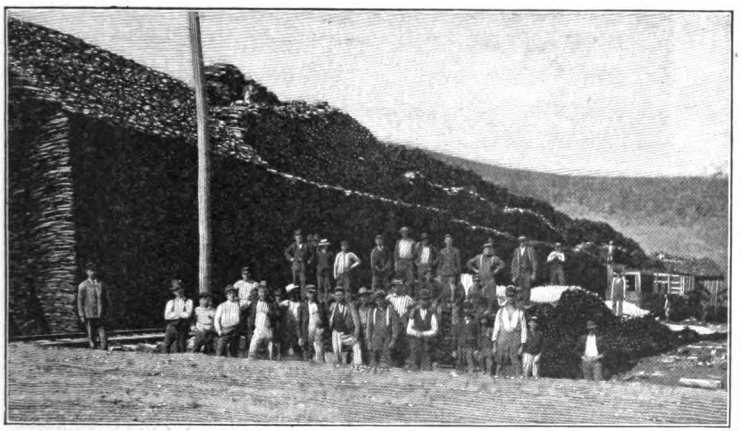
In other important ways, also, the Appalachian Mountains have had great influence upon our history. Slavery did not thrive among the population of the mountain regions, and, as a consequence, during the Civil War, the mountain inhabitants sided largely with the Union cause. This drove a strong wedge of Union sentiment far into the South, and separated the Western slave states from the Eastern. Throughout the valley of east Tennessee there was a strong Union sentiment.

Products of the Appalachian Regions

It has taken the American people more than two hundred years to discover and bring to light the natural riches of the Appalachian Mountains. When the pioneers made their first toilsome journeys across these mountains in order to reach the rich valleys and plains of the Ohio and its tributaries, they little dreamed that they were passing through regions of boundless wealth, that these mountains had concealed in them vast treasures of coal and iron, of oil, and natural gas, of marble and limestone, and that the forests on the shaggy mountain sides would one day be worth as much per acre as the soil of Ohio or Kentucky.

The forests that covered the whole Appalachian region, and so much interfered with the progress of settlers, have been for a hundred years a large source of wealth and at the present time are supplying immense quantities of lumber. In Pennsylvania and in the northern sections much of it has been stripped away by the sawmill companies. At Williamsport, on the upper Susquehanna, at one time there were forty-one sawmills. The logs were cut along

the mountain sides, and in times of abundant water floated down the smaller streams to the Susquehanna, and collected at the mills of Williamsport. From this point the railroads distributed the lumber to the Eastern cities. Even now one sees extensive rafts of logs lying in the broad basins and bayous connecting with the river at Williamsport, close by the big sawmills.



Hemlock Bark.

Throughout the mountainous parts of New England and of the Middle and Southern states are scores of cities where the lumber business has been of large extent. In addition to the lumber, the bark of the hemlock has been used in immense quantities in the tanning of leather. In New England and the Middle states, the poplar and spruce have been used over extensive areas to make paper pulp, for use in wrappings, newspapers, and books. This is one of the large industries of New England and the Middle

states. The great Appalachian forests have been utilized, not only for ordinary building purposes, but for shipbuilding, for railroad construction, for furniture factories, for paper pulp, for tanning, and for fuel. In Virginia, Tennessee, and the southern Appalachians, fine forests of oak, walnut, hickory, and poplar are still awaiting the approach of railroads to bring them to market.

The more mountainous districts, as the Adirondacks in the north, and the southern Appalachians, are still clothed with extensive forests. Generally the highest peaks of this system are covered completely with forests to their summits. This gives a distinct wooded aspect to all views of these mountains. They seldom present the appearance of peaks or rocky pinnacles, but are broadly rounded and forest clad. Only along the narrow river valleys and at the gaps and gorges which the rivers have cut through the ridges, do we find steep and rugged rock masses, as at Harper's Ferry, the Delaware Water Gap, the Chickamauga passes below Lookout Mountain, and the passage of the James through the Blue Ridge.

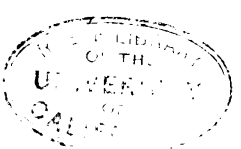
The danger of the present time is that the great lumber companies in their natural desire to do a prosperous business will devastate the mountains of their forests. The government of the United States has already taken steps to protect and preserve large areas of forest by converting them into national forest preserves. In the Adirondacks, in the White Mountains, in the mountains of Pennsylvania and North Carolina, and in the Rocky Mountain states such forest preserves have been established.

Powerful reasons have influenced the government to interfere for the protection of forests. These mountain

regions are the sources of our rivers and help to regulate the flow of water, which is of great importance to the people living in the lower river courses, for navigation, and for water power.

Speaking of New York, Mr. R. H. Whitbeck says: "The forests as well as the lakes are important in regulating the flow of streams. In the shade of the woods snow is protected from melting, and the water is checked from running rapidly away by the tangle of roots, the moss, and leaves. When the forest is cut away, however, the rain waters and the waters of the melting snow run quickly off, then the streams are flooded at one time and nearly or quite dry at another. Partly for this reason, partly because of the beauty and attractiveness of the forest, and partly because the removal of the timber has been so rapid that its total destruction has been threatened, the state has set aside large tracts, forming the Adirondack Forest Reserve, held and protected from destruction for the benefit of the people."

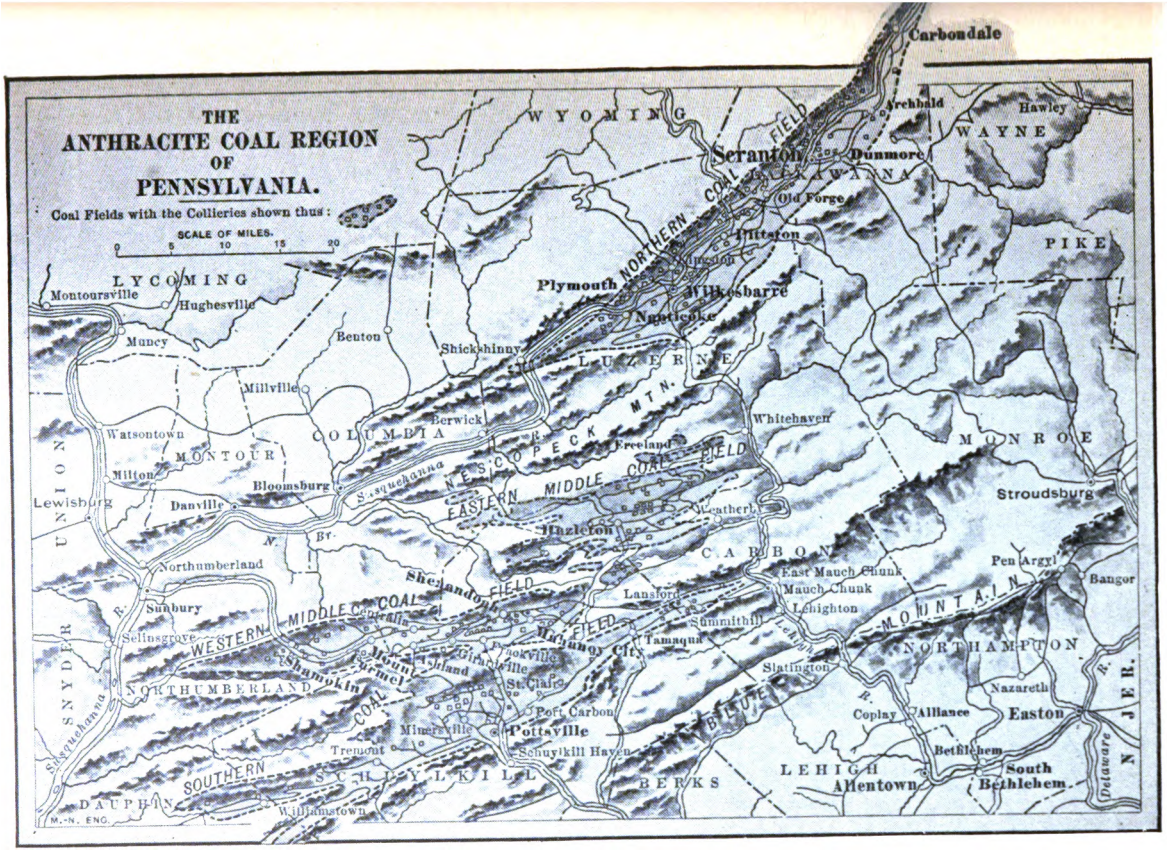
The Appalachians are peculiarly rich in coal-fields, both of anthracite and bituminous. The hard coal district of northeastern Pennsylvania at the present time furnishes an enormous amount of coal for consumption in the eastern half of the United States. Some of the veins of hard coal, as at Hazleton, where the top has been stripped off, show a thickness of forty feet. In the western half of the state, and extending southward past Pittsburg about eight hundred miles to central Alabama, is a coal-field of vast extent and richness. At Connellsville, Pennsylvania, south of Pittsburg, for example, are rich veins of coking coal seven feet in thickness, which supply many of the large furnaces at Pittsburg. The Monongahela Valley is



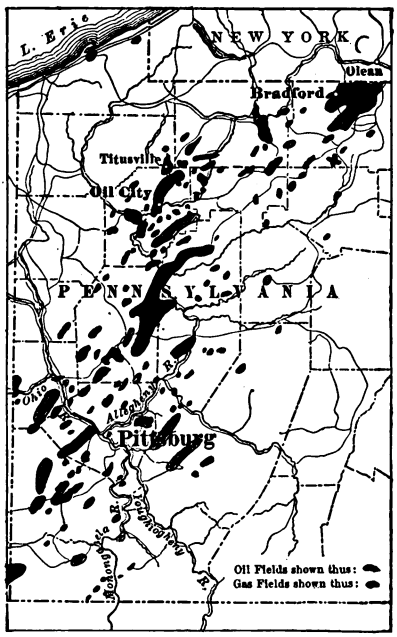
lined with coal mines, which load tens of thousands of tons daily into barges or upon railroad cars for the large steel and iron works at Pittsburg and neighborhood. In this region farm lands have been sold recently for $1000 per acre, fifty miles from Pittsburg, to companies wishing to secure coal rights. In West Virginia, in Tennessee, in Alabama, and in Kentucky, as well as in other states, this coal region is already producing extensively. These vast coal-fields seem inexhaustible, and are not only capable of satisfying the present large demand for coal, but its increase for centuries to come. This region is also prolific in the production of natural gas, and the estimate of its resources for illuminating, heating, and factory purposes runs far into the millions.

In the district north of Pittsburg the abundant flow of petroleum from thousands of oil wells has been a source of vast wealth to great corporations. Fire clay for brick and pottery, sand for glass-making, and quarries for building stone — as granite, limestone, and marble — have been abundantly developed in the southern as well as in the northern Appalachian regions. In New England, they have become the foundation of great industries. Manganese, for use in the steel-works, even zinc, lead, and gold, have been mined in the southern Appalachians. Gypsum, salt, and slate are also important products of the mountain belt.

The iron mines of the Appalachian Mountains are also extensive, and have been liberally exploited, especially in eastern Pennsylvania, New York, Virginia, New Jersey, Alabama, and other states. But in recent years the very rich iron mines of the Lake Superior region have supplied the market of Pittsburg.


THE
ANTHRACITE COAL REGION
OF
PENNSYLVANIA.
Coal Fields with the Collieries shown thus :
SCALE OF MILES.
0 5 10 15 20
Carbondale
Archbald
Hawley
WAYNE
WYOMING
Scranton
Dunmore
LACKAWANNA
NORTHERN COAL FIELD
Old Forge
Pittston
PIKE
LYCOMING
Montoursville
Hughesville
Plymouth
Wilkesbarre
Nanticoke
Kingston
Muncy
Benton
Shickshinny
LUZERNE
Millville
Berwick
Whitehaven
MONROE
Watsontown
COLUMBIA
MONTOUR
Milton
Bloomsburg
Susquehanna R.
Freeland
NESCOPECK MTN.
EASTERN MIDDLE COAL FIELD
Stroudsburg
Lewisburg
Danville
UNION
Br. N.
Hazleton
Weatherly
CARBON
Northumberland
Shenandoah
Pen Argyl
Bangor
East Mauch Chunk
Mauch Chunk
Lehighton
Sunbury
Lansford
Selinsgrove
WESTERN MIDDLE COAL FIELD
Summithill
Tamaqua
MOUNT. N.
Mahanoy City
Shamokin
Mount Carmel
Girardville
Ashland
Slatington
NORTHAMPTON
SNYDER
NORTHUMBERLAND
St. Clair
Port Carbon
Nazareth
Coplay
Allance
Easton
Minersville
Pottsville
Schuylkill Haven
Tremont
Bethlehem
LEHIGH
Allentown
South Bethlehem
SOUTHERN
SCHUYLKILL
BERKS
DAUPHIN
Williamstown
M.-N. ENG.
Susquehanna R.
Delaware R.
N. J. E. R.

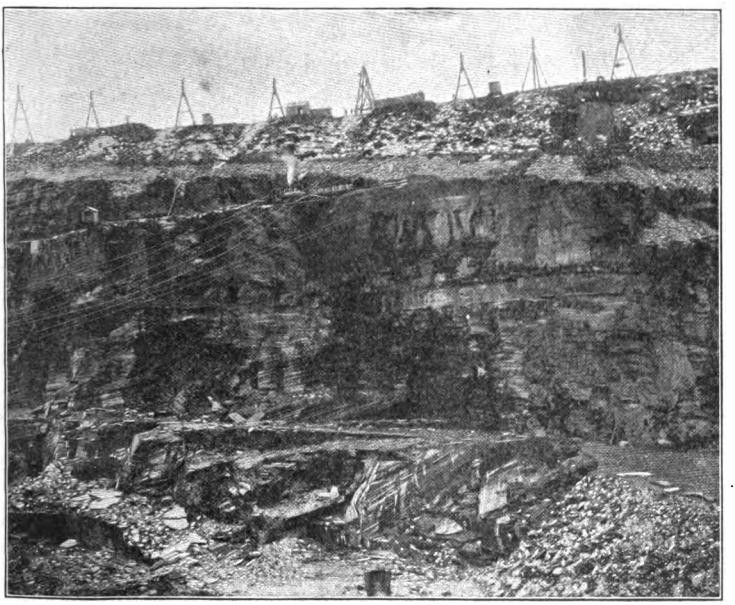
But forests, coal, iron, oil, and minerals are only the more prominent products of this mountain district. An abundant agriculture flourishes throughout many of the beautiful and healthful mountain valleys. The level or rolling upland valleys produce quantities of grain, fruits, and tobacco, while the mountain slopes, when stripped of their forests, supply pasture lands for thousands of cattle and other livestock.



Oil and Gas Fields of Western Pennsylvania.

The Great Valley of Virginia is devoted to mining, manufacturing, and stock-raising. "From here, especially the counties of Smyth, Wythe, and Pulaski, great quantities of cattle are shipped to Europe and South America. In Smyth is a ten-thousand-acre blue-grass stock farm, which is said to have the largest herd of short-horned cattle in the world. This farm ships more cattle to South America than other American breeders. This whole section raises fine horses, sheep, and cattle." (Virginia, supplementary volume of Tarr and McMurry Geographies.)

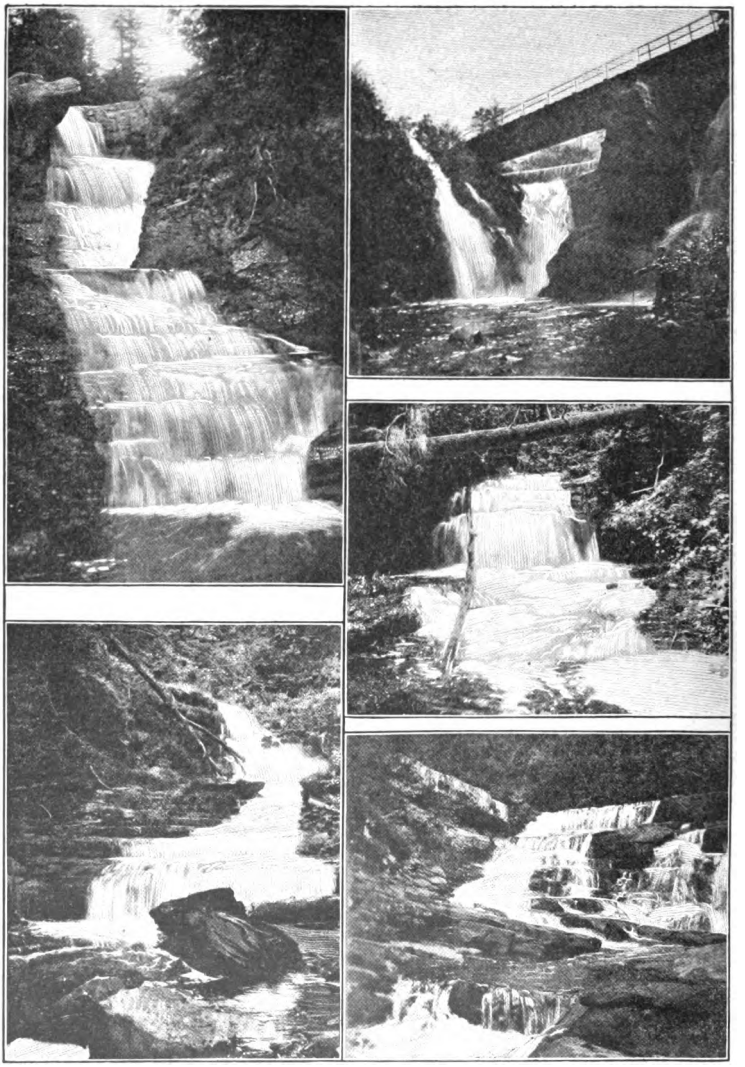
Among the southern spurs and outlying ridges of the



Slate Quarry.

Appalachians are a number of flourishing cities which have grown prosperous and wealthy, in recent years, by exploiting the natural riches of the mountain belt. Such are Atlanta, Knoxville, Chattanooga, Birmingham, and Asheville.

The water power in these mountain districts, from New England to Georgia and Alabama, has been largely used for mill and mining purposes. Most of the rivers descending from the mountains and uplands have rapids and falls, and there are many favorable mill sites. But in the future these water powers throughout the Alleghanies are likely to become far more valuable because of the recent

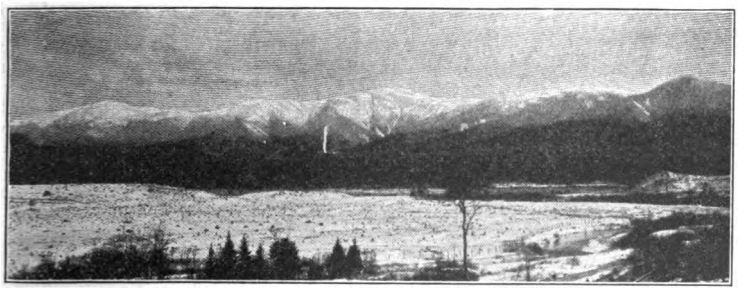


Falls in Pennsylvania.

methods of converting water power into electrical force, and its easy transmission for long distances. The eastern slopes of the Blue Ridge down to the Piedmont uplands are steep, and the rivers, where they break through the mountains, descend in rapids and falls hundreds of feet to the more level country. For example, there are falls in the James where it breaks through the Blue Ridge.

Especially in the southern Appalachians of Carolina the streams flowing eastward plunge immediately downward in a series of cascades, falling several thousand feet in a few miles.

"The southern Appalachians are rich in water power. The streams which flow westward from the mountain belt



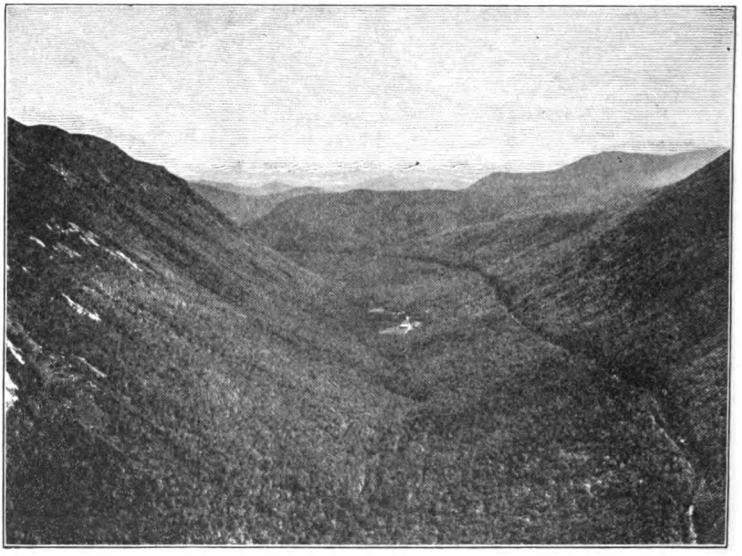
The Presidential Range.

(east of the Great Smokies) have high catchment basins with high intermontane valleys. In their courses to the Appalachian valley (of East Tennessee) are many rapids, particularly where they break through the Unaka range, and much of the water power now going to waste will undoubtedly be utilized before many decades." (C. W. Hayes, "The Southern Appalachians.")

UNIVERSITY OF CALIFORNIA

Population and Resorts.

The people of the Appalachian Mountains make up a considerable portion of the population of the United States. An examination of a map showing the density of population in our country indicates that the Appalachian regions



Crawford Notch, White Mountains.

are, on the average, about as densely populated as the rest of the United States east of the Mississippi River. In certain mountain districts, cities are thickly clustered, as in the anthracite region (Scranton, Wilkesbarre, Mauch Chunk, etc.), also in western Pennsylvania about Altoona and Pittsburg, and in the Great Valley of Virginia and of Tennessee.

Some of the more rugged and isolated mountain districts, as the central Adirondacks, the plateaus and high mountains of North Carolina, and the eastern uplands of Kentucky and West Virginia, have but a scattered population. But even the more wild and picturesque mountain valleys and peaks are being rapidly approached and converted into summer resorts, where tens of thousands, and even hundreds of thousands of people seek summer comfort and pleasure. Even these once lonely districts are beginning to have their throngs of summer visitors.

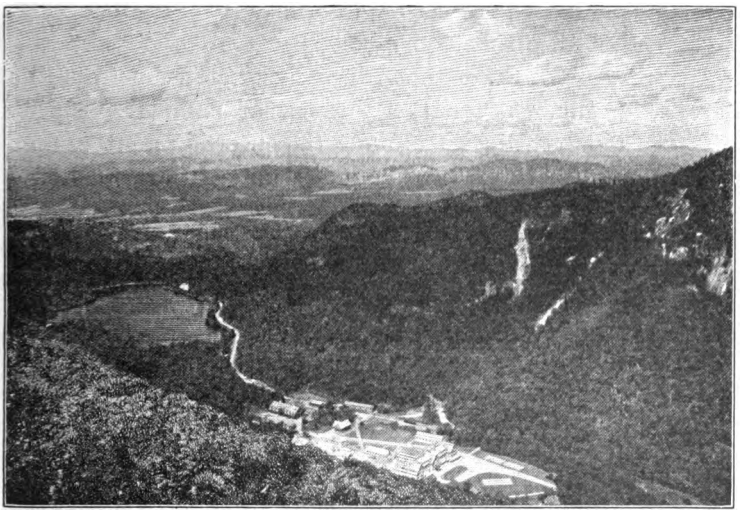
The White Mountains in New Hampshire have long been famous as a summer resort. The Presidential range, with Mt. Washington as its crowning summit, is the centre of this region. The famous notches are deep cuts through which the railways pass along these mountains. "There are large hotels for summer tourists in the notches and in some of the surrounding villages, such as Bethlehem and North Conway, and in all the mountain towns there are many boarding-houses. Tens of thousands of people come here yearly to escape the cares of city life and to gain health and pleasure while climbing the mountain trails, driving along picturesque country roads, enjoying outdoor sports, or quietly watching cloud shadows pass across the grand mountain views. There are also many boarding-houses and cottage homes in the southern upland, especially on the shores of Lake Winnepesaukee, Lake Sunapee, and other beautiful sheets of water." (Philip Emerson in Supplement to Tarr and McMurry's Geography.)

Good carriage roads are also built through the valleys and along the mountain sides, and a cog-wheel railroad

The White Mountains.

ascends to the top of Mt. Washington, by means of which many may enjoy the broad mountain views.

Maine, in its forest-covered tract, has become a resort in a somewhat different way. "Mountains rise above the rugged upland, and from their summits one may see many lakes of the wilderness, gleaming like silver amid the dark



Looking North from Franconia Notch.

forests. There are many deer and moose and a few caribou in these wild lands. The deer and moose are protected most of the year by state laws, and the shooting of caribou has been prohibited for several years. During the open season, in the fall, thousands of sportsmen from the cities spend a week or more at camps or remote lakes, enjoying the crisp air, the beauty of the woodlands, and the excite-

ment of hunting big game. Nearly two thousand men are registered as guides, and many taxidermists are employed in preparing skins, heads, and antlers as trophies. The lakes and streams, well stocked with trout and other fish, attract many anglers. With guides they often make long canoe trips, for example, through the Lake District of Washington County or down the west branch of the Penobscot from the 'carry' at the head of Moosehead Lake." (Philip Emerson.)

In New York State the Adirondacks and the Catskills are alike famous for the throngs of summer visitors. Hotels and boarding-houses for the entertainment of tens of thousands of tourists abound. Where the river cuts its way through a mountain range lies the beautiful and much visited scenery of the Hudson Highlands.

In Pennsylvania, among the high plateaus of the northern part of the state, are many lakes and cool summer retreats. The Delaware Water Gap, with its large summer hotels and striking mountain scenery, is not far from New York City, and is a favorite place for rest and quiet.

The beautiful valleys of Virginia are famous for their mineral springs, such as the White Sulphur, the Chalybeate, the Rockbridge Alum, and others. The cool summer hotels located among picturesque valleys and mountain slopes are filled with health and pleasure seekers in summer. Among favorite places are Luray Cave, Weyers Cave, and the Natural Bridge.

The mountain region about Asheville, North Carolina, is much visited by health seekers, while the Great Smoky Mountains are beginning to attract many summer excursionists. Lookout Mountain has upon its summit a large

hotel, looking down seventeen hundred feet upon the city of Chattanooga. The Cumberland Plateau, in Tennessee, also has its summer visitors and attractions. Indeed, the southern Appalachians are much frequented in recent years by people from the hot Southern states in summer time. Doubtless, as the years go by, the Southern people will flock more and more to the mountains to find refreshment and recreation.

All the way from northern Maine to Georgia and Alabama the mountain districts, once looked upon as the lonesome backwoods regions of our country, and as such dreaded and avoided by travellers, are becoming yearly the delightful summer outing places and sanitaria for hundreds of thousands of dwellers in the cities.

Climate

Although the Appalachian Mountains stretch more than one thousand miles in a broad belt of ranges athwart the eastern section of the United States, they do not greatly modify the climate either of the Atlantic coast states or of the Ohio Valley. The climate along the western slopes is not far different from that of the Piedmont belt east of the Blue Ridge. As a rule, the mountains are not high enough to interfere seriously with the passage of the winds between the east and the west, though the rainfall is to some extent affected by condensation upon the higher mountain ridges.

The Atlantic coast lands, being exposed to the influence of the ocean on one side, and protected somewhat from the northwest winds, have a climate somewhat milder and more humid than the western slopes.

Among the elevated mountain valleys of the Carolinas

and of Virginia, and in the plateau regions, a colder climate prevails in winter than in the lower lands on either side. Stretching more than a thousand miles from north to south, the mountains exhibit a striking contrast between the climatic conditions on the northern border of Maine and those of the southern Appalachians. Early in December, when the northern mountains are covered with snow, and are already in the firm grip of winter, the southern mountains are still aglow with autumn colors, and the days are still warm in the southern sun.

In conclusion, it may be said that the regions included in the Appalachian Mountains, by their great natural resources in agriculture, minerals, and forest lands, by their commanding influence in determining the chief routes of traffic and the location of important cities, by their increasing popularity as summer homes and health resorts, and by their present population and wealth, have established themselves as among the controlling and interesting physical regions of our country.

The foregoing general treatment of the Appalachian Mountains as a whole, as one unit of thought, enables us to organize a great body of somewhat scattered knowledge and to put each fragment in its proper place.

In our later study of mountain regions this Appalachian Mountain belt may serve as a standard unit with which to measure other larger mountain systems, while helping also to interpret their meaning.

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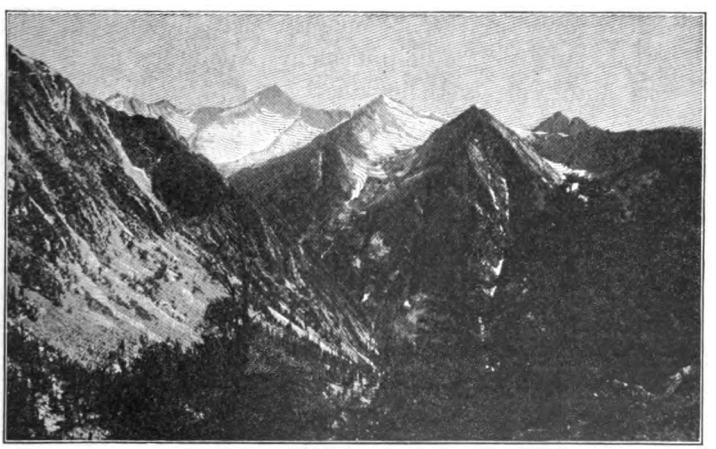
THE ROCKY MOUNTAINS

THE Rocky Mountains occupy about one-third of the United States. They are but a section of a still greater system extending from northwestern Alaska to the Isthmus of Panama, and continued through South America to Cape Horn. The widest part of these mountains, on



A Scene in the High Sierra Nevada, Mt. Brewer in the Background.

the fortieth degree of latitude near which Denver lies, is about one thousand miles. They stretch some twelve hundred miles over the western part of the United States from north to south.

A glance at a large relief map of this region shows a confusion of mountains which even a closer study does not bring into clearly distinct ranges. Of these the eastern range was first known as the Rocky Mountains, and the western as the Sierra Nevada, continued northward in the Cascade range. Between these lies a broad wilderness of plateaus, and lower mountain ranges, stretching for the most part from north to south, but occasionally from east to west; also sand deserts, lava plains, and rivers lost to sight and winding hundreds of miles through deep cañons sunk in the plateaus.

It is difficult to get an adequate conception of this complicated mountain tract. Our previous study of the Alleghany Mountains can help us somewhat by contrast. The Rocky Mountains at their widest expansion on the latitude of Denver are more than three times the width of the Appalachians. The average height of the ranges is also about three times that of the Eastern mountains. The chief ranges of the Rocky Mountains rise from a plateau nearly as high as the summit of Mt. Washington, or about one mile above sea level. On the east of the Rocky Mountains the lands stretching away to the Missouri have been usually called "the plains," but a better name would be the plateaus, since they attain a high level before reaching the foot of the mountains. On the west, the Sierra Nevada and Cascade ranges descend more abruptly, with intervening valleys and ranges, toward the sea. The higher ranges of this system, set upon a plateau loftier than the upper ranges of the Appalachians, tower still thousands of feet above the forest limit. Not merely single mountains, like Longs and Pikes peaks, but whole ranges lift their

stony backs above the tree line, and present a wholly different aspect from the green forest-clad summits of the Appalachians.

As a whole, the Rocky Mountains are in an arid region, with some important exceptions on the western slopes. This is due partly to the fact that the high Sierra and Cascade ranges interrupt the moisture-laden winds from the Pacific, and send them across the plateaus deprived of most of their blessing. The higher mountains, such as the main ridge of the Rockies, or the Wasatch, just east of Salt Lake, catch the winds either from the east or the west, and press out their remaining moisture. This is sufficient not only to cover these higher ranges with deep snows in winter and to supply rains in summer, but to give rise to great rivers, which, descending from the mountains, flow eastward across the plains, as the Missouri, Platte, and Arkansas, or cross the plateau belt westward to the Pacific, as the Colorado and Columbia. The middle slopes of these higher mountains are forest clad, being supplied with moisture as above shown, and even the loftier plateaus are rich in forests, while the lower plateau regions are arid and even desert, as those of Utah and Nevada in the Great Basin.

The physical features of the Rocky Mountains are, therefore, strikingly different from those of the Appalachians. The whole Appalachian region is bathed in moisture, and green with forests or agriculture. The upper summits and huge ridges of the Rockies, towering at times into domes and pinnacles, are too cold and forbidding for vegetation, and many wide stretches of rugged plateau are desert and dismal beyond expression. The Rocky Mountain scenery is on a grand scale. On the western

slopes of the Cascades, "when it rains, it pours," and the mountain slopes are covered with stately and gigantic forests surpassing anything seen from Maine to Georgia. The giant sequoia forests of the Sierra Nevada are the unrivalled wonder of the world among trees. The cañons of the Colorado, in the brilliancy of their rock coloring and in the profound depths of their gloomy chasms, are scarcely equalled elsewhere. The series of towering extinct volcanoes scattered along the Sierra Nevada and Cascade ranges give an imposing beauty and grandeur to the Pacific scenery which even the eastern Rockies do not approach. The great lava floods poured over the plateau region, and covering many thousands of square miles, as in eastern Washington, reveal, on a large scale, the extent of ancient volcanic action. The hot Mohave Desert of southeastern California, and the Salt Desert of western Utah, are good samples of the greater deserts of Africa and Asia.

The Rocky Mountain Ridge along the eastern border of the great belt is chiefly notable for a series of picturesque and interesting parks. Most notable, in the north, is the Yellowstone Park, of national fame for its geysers, falls, lakes, and hot wells and springs. Farther south, in Colorado, are North, Middle, and South parks, upland valleys enclosed by towering mountains, and frequented by summer hunters and outing parties. San Luis Park, in southern Colorado and New Mexico, is the upper valley of the Rio Grande, of much fertility and beauty.

The volcanoes of the Sierra Nevada and Cascade ranges are their most distinguishing feature. Mt. Shasta, in northern California, towering far above all surrounding mountains, is a striking illustration of the power of successive

eruptions and lava flows to build up a mountain mass as huge as Pikes Peak, and almost cone-shaped. Since the fires have left its crater, ice and snow have taken possession of its top and upper slopes, and five small glaciers give rise to streams which have cut deep cañons through the middle zone of the mountainside.

Yellowstone.

Mt. Hood, in northern Oregon, and Mt. Ranier, in Washington, are very striking and imposing volcanic peaks, as they stand out in greater isolation when seen from near valleys at sea level. In British America, and in Mexico, the volcanic belt is continued in both directions, and in both the mountains and volcanic peaks rise much higher than in the United States. Indeed, this series is continued southward in the great volcanoes of the Andes,

and gives not only the longest series of mountains, but also of great volcanoes in the world.

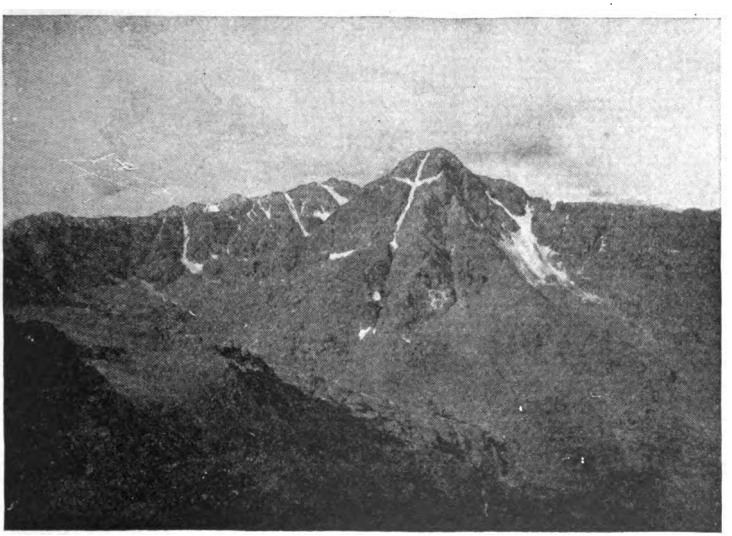
Between the eastern and western ranges of the Rocky Mountains lie three principal regions. First, is the Columbia plateau on the north. "It is a complex of plateaus of diastrophic and volcanic origin, relieved by a few great

Mt. Shasta.

mountains and having many beautiful valleys. The highlands are covered with forests, the lowlands are naked. Extensive lava beds were poured out over this region in a time of great volcanic activity, valleys were often dammed up, and behind these obstructions many lakes were formed. Many of these lake beds have been drained and the old lake levels are rich agricultural lands. Snake River runs for hundreds of miles of its course through a cañon carved in the lavas. The walls of the cañon are often precipitous, effectually barring cross-river transit. In places late coulées (lava flows) have dammed the river. Shoshone

Falls (on the Snake River) are formed in this manner. Here a mad torrent of water plunges over a great lava dam in a cataract of grandeur." (J. W. Powell, "Physiographic Regions of the United States.")

The middle region is the Great Basin, which has no outlet to the sea. It has numerous rivers flowing into salt seas and sinks, or disappearing in desert sands, such as the Jordan in Utah, and the Humboldt in Nevada. Salt Lake is the most remarkable of these inland seas, once a great



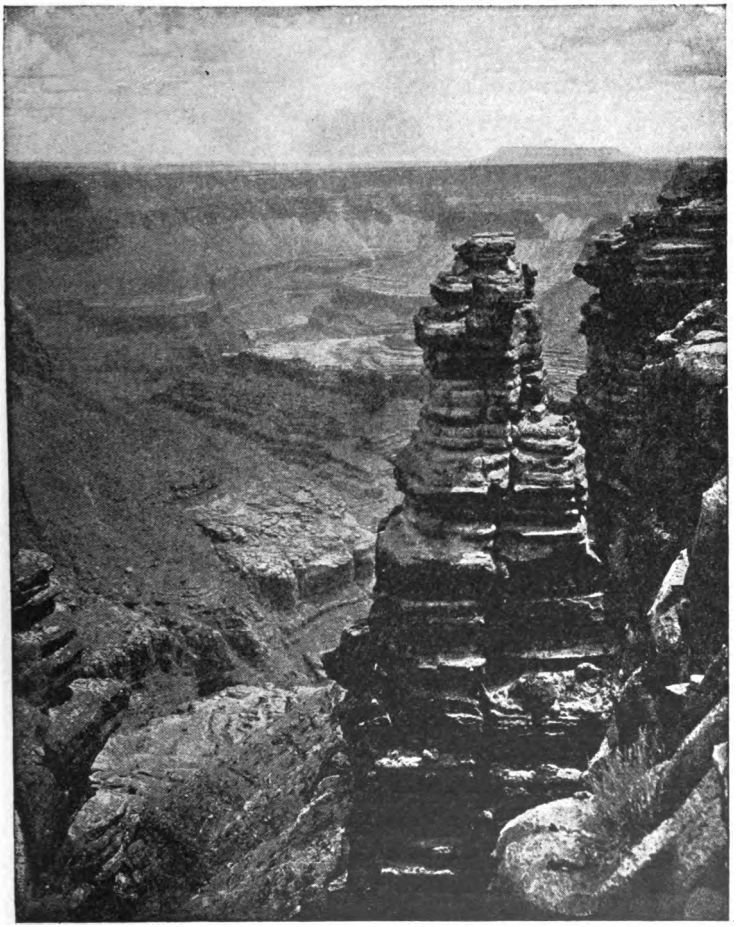
Mt. of the Holy Cross, Colorado.

fresh water lake, when the climate was humid, but now shrunk to a tenth of its ancient size, and leaving great salt deserts where it once spread its waters.

The third district is the Colorado plateau, drained by the great cañon river and its tributaries, which have sunk their channels into its rocks. "The streams usually have deep channels. Little rills, born of showers and dying with the sunshine, have often cut deep but narrow, wind-

Whitney Glacier, Mt. Shasta.

ing gorges, at the bottom of which great caves are often found. The creeks have cut larger cañons and the rivers have cut mighty cañons, — gorges sometimes hundreds of miles in length. So there are cañons along the rivers, smaller cañons along the creeks, still smaller cañons along the brooks, and picturesque cañons along the wet-weather



Brink of the Grand Cañon.

rills; and the plateaus are thus divided into a labyrinth of deep gorges." (J. W. Powell.)

In contrast with the coastal plain east of the Appalachians the western Rockies have almost none. But the main ridge of the Sierra Nevada and Cascades drops abruptly into valleys, which are shut out from the sea by lower coastal ranges. Such is the valley of Puget Sound in Washington, partly drowned by the sea, the Willamette Valley in Oregon, and the great valley of California drained by the Sacramento and San Joaquin.

The late history of the Rocky Mountain region falls into three easy divisions. First was the period of exploration. Before the Louisiana Purchase from France in 1804, the whole vast West was little known. With the expedition of Lewis and Clarke up the Missouri and across the lofty and tangled ridges of Montana, then down the Columbia to the Pacific, the American occupation began. Forty years later the expedition of Frémont across the Middle Rockies and Salt Lake to California brought to the world a fuller knowledge of these regions. These were all government expeditions, partly geographic, partly scientific. Still later Powell, in a series of hardy exploits, descended the mighty cañon of the Colorado in frail boats, and reported its long and gloomy depths, and its stupendous and glowing rock panoramas to the world.

With the discovery of gold in California in 1848, began the large movement of thousands of emigrants across the plains, plateaus, and mountains to California. Then were laid out the long wagon trails for pack trains. California soon came into existence as a state. Ten years later a like discovery of gold in the region of Pikes Peak carried a

host of adventurers and home seekers into Colorado, and peopled that region with a growing commonwealth. The discovery of gold, silver, and copper mines in other mountain states has led to a similar movement of fortune seekers and settlers to all the western territories. Early in the forties the Mormons settled about Salt Lake, and developed its agricultural resources by irrigation.

The third important epoch was that of railroad construction. The West was not yet sufficiently settled and developed to provide for itself the immense cost of railroad construction across rugged mountains and plateaus. But the whole nation was interested in the commercial conquest of the West and in a great continental line that would join the Atlantic and the Pacific. In 1864, therefore, before the close of the Civil War, President Lincoln signed a bill passed by Congress for the building of the first Pacific railroad. By 1869 it was completed, and since then the regular and systematic development of the resources of the whole broad mountain region has followed. Several other important railroads, both north and south of the Union Pacific, have passed over the mountains to the Pacific coast, and a large group of new and powerful states have come into vigorous life.

The development of the Rocky Mountain regions has been far more rapid than that of the Appalachian Mountains, because the power and resources of the American people in recent years have been far greater. The railroads themselves have been among the chief instruments of rapid pioneering, carrying thousands of people into new and undeveloped regions.

The natural resources of the Rocky Mountains as they

have come to light in recent years are far greater than the early explorers and pioneers of fifty years ago even suspected. They rushed on long and toilsome journeys to California, little dreaming that Denver, Pueblo, and Leadville in Colorado would spring up in their footsteps and surpass the early riches of California. Broad tracts in the eastern Rocky Mountain states, then supposed to be hopeless deserts, by irrigation have been changed into gardens and fields of abundance.

The prominent occupations that have developed in the Rocky Mountain and Pacific states are due partly to their peculiar mineral resources, and partly to their physical and climatic conditions. The precious metals have been unearthed from their rocky strata, or washed from the river sands in most of the Western states, but especially in Colorado, California, and Montana, where some of the richest mines of copper, silver, and gold are found. Iron and coal have also been found in considerable abundance in many districts, but especially west of Pueblo, Colorado, and superior coal veins are developed in Washington. But in coal and iron the Rocky Mountains, so far as yet prospected, cannot compare with the Appalachians, while in precious metals the Appalachians have relatively little to show. In the Rocky Mountains a score of important cities have sprung up in and near the centres of mining industry, as Leadville, Denver, Pueblo, Cripple Creek, Butte, Virginia City, Tucson, Helena, Great Falls, San Francisco, and others.

Irrigation, unknown in the Appalachians, has grown to an importance undreamed of by the pioneers. First individuals, and later large and wealthy companies, built dams

in the rivers and carried out large irrigating ditches over extensive areas. Colorado and California take the lead also in irrigation, and thus derive as much wealth from agriculture as from mines. In the last few years the government of the United States has begun a wise and liberal plan of building dams and reservoirs in the mountains for the storage of waters from melting snows and spring floods. Hundreds of thousands of acres are thus brought under irrigating ditches, and small farms are sold to settlers and homesteaders, so that these immense works are eventually paid for by the settlers who derive the chief benefit. A great irrigation dam and series of ditches, recently constructed by the government on the Truckee River in western Nevada, will bring about three hundred thousand acres of good land under cultivation. Within a year it has been opened up by the government for purchase and settlement by the people. By such wise measures, and with little expense to itself, the government encourages the more rapid development of the West.

In the Pacific states, as Washington, Oregon, and California, there are extensive tracts where the rainfall is sufficient for the cultivation of wheat. Eastern Washington, southwest of Spokane, has such a broad wheat and farming belt. Agriculture, therefore, in form adapted to the climate, is already the most important occupation of the West, and in the future is likely to find a far greater extension. On this account the population of the West has greatly increased and will become much larger than was formerly imagined possible.

An arid country like the West, abounding in plateaus and mountain slopes, covered with a scant vegetation, is a

natural grazing region. Throughout the plateaus and plains just east of the Rockies, and among the broad valleys of the mountains, in Montana, Wyoming, Colorado, and New Mexico, hundreds of extensive cattle ranches are the breeding-places where large herds are grown in prepa-

Redwood Trees.

ration for the eastern market. In Utah and other states sheep ranches abound, and, as in the Alps, the herdsmen drive their flocks to the higher levels with the progress of the season, returning to the valleys in the fall.

The coast ranges near the Pacific, and the higher Sierra Nevada and Cascade mountains, being bathed with moist winds from the Pacific, are clad with mighty forests, which give rise to extensive lumbering. This business has been of great importance in the development of the extreme Northwest and in the growth of its cities, — Portland,

Seattle, Tacoma, and others. As already noted, there are many other extensive forests distributed upon the mountain slopes and high plateaus, wherever the elevation is sufficient to condense the moisture of the favoring winds. Lumbering, which supplies immense quantities of materials needed in mining, in the construction and maintenance of railroads, and in the building trades, is extensively carried on in all the Western states. The salmon fisheries of the Columbia, of Puget Sound, and of the coast rivers further north are also valued at many millions.

All the occupations of the Western mountain states are of recent growth, and it is not yet possible to tell their future importance. Lumber, agriculture, and grazing are similar in character to those occupations in the Appalachians, but in mining, the precious metals stand out pre-eminent as against the more useful and also more valuable coal, iron, and petroleum of the eastern Highlands.

Manufacturing in the West is mostly confined to the working over of the forests and minerals, the logs and ores, obtained in those states. There are large smelting furnaces at Pueblo, Great Falls, Denver, Butte, and other mining centres.

Just as Albany, Pittsburg, Chattanooga, and Atlanta, as centres of trade, lie at the gateways of the eastern mountains, in like manner Pueblo, at the outlet of the Arkansas, Denver, and Helena command the approaches to the Rockies, while Seattle, Portland, San Francisco, and Los Angeles control the traffic of the western slopes and the ocean.

As for mountain resorts, beautiful and imposing scenery, and sanitaria for health seekers, the western mountains are

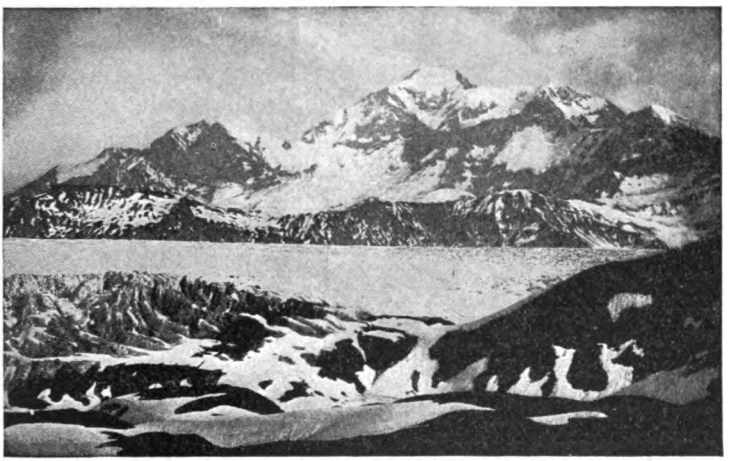
supposed to excel greatly the eastern. Every summer Colorado Springs and Manitou, at the foot of Pikes Peak, receive hundreds of thousands of visitors. The Yellowstone Park is likely to prove one of the greatest national pleasure grounds in the world. The park lands of the Rockies in Wyoming and Colorado have attracted summer visitors for many years. The Grand Cañon only recently has been made accessible by railroad at one place, but it cannot fail to become in time an unparalleled attraction to thousands of sightseers.

In California, Yosemite Valley, the groves of giant sequoias, the lake regions of the Sierra Nevada, Mt. Shasta, and many other places, have been called the "Wonderland" of the West. The mountains that encircle Puget Sound, with their towering extinct volcanoes, are full of the surprises of mountain land. These named, however, are but specimens of a host of similar scenes of grandeur and beauty, which only future generations can fully enjoy. The great distance and expense of reaching the western mountains from the Eastern states prevent many thousands from journeying thither.

The Rocky Mountains extending northward into British America grow still more lofty and rugged. The gigantic scenery of southern Alaska is far more imposing than any other part of the United States or of Switzerland. The glaciers which descend through the mountain valleys to the Alaskan coast far exceed the Alpine glaciers in magnitude.

The extension of the Rocky Mountains into Mexico also displays a great plateau region, and towering volcanoes which greatly exceed in height those of the United States.

The Rocky Mountain system as a whole, extending through the length of the continent from Bering Sea to



Above Snow Line, Alaska.

the Isthmus of Panama, may be well called the backbone of North America. From it spring the great rivers, and the climate of more than half the continent is largely determined by this mountain system.

For one equipped with a knowledge of this varied and extended mountain belt, it will not be difficult to interpret the mountain systems of the other continents.

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THE PENNSYLVANIA RAILROAD

THE Pennsylvania Railroad, operating at the present time more than ten thousand miles of traffic lines, is one of the large railroad systems of the United States.

The earliest parts of the present Pennsylvania system consisted of two short railroad lines built to connect the canal systems of the state of Pennsylvania. An important system of canals had been built by the state of Pennsylvania previous to 1825, before any railroads were undertaken. Rivers and canals had long been (till 1830) the chief means of shipping goods, and as railroads were unknown, the extension of the canal system was regarded as all-important. A canal along the Susquehanna connected Harrisburg with the tide water.

The canal commission of Pennsylvania, under state authority, built the first short railroad line from Philadelphia to Columbia on the Susquehanna, some thirty miles south of Harrisburg. A state canal reached from Columbia to Harrisburg and northward, crossing the Susquehanna River and continuing up the Juniata River to the base of the great Alleghany Plateau and divide.

This first railroad, a double track, was completed at state expense in 1834. Just west of Philadelphia it used an inclined plane 2845 feet long to reach the height of 187 feet near Ardmore. At Columbia, also, on the Susquehanna, an inclined plane was used to lower the track 90 feet to the level of the canal where boats received the

passengers and goods for Harrisburg. When trains were brought by stationary engines to the top of these planes, they could be hauled over the main line between the inclined planes by horses or engines.

As this road was built at state expense, it was for public use, like an ordinary highway, and any one could place his own wagon or car on the track and haul it over this road by horses or mules.

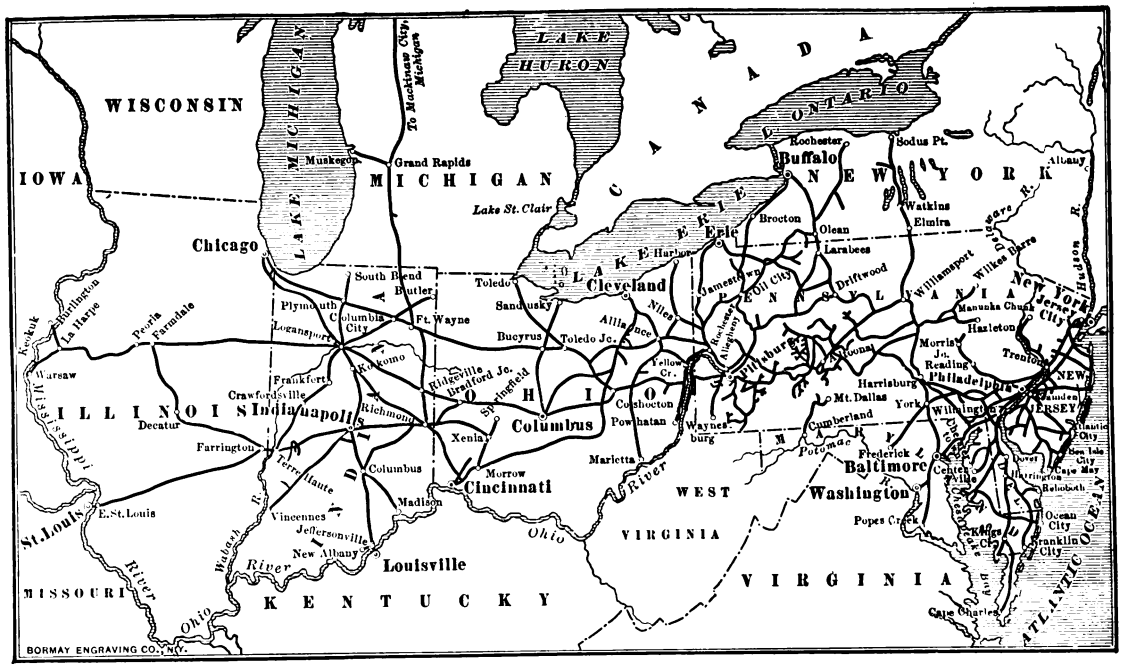
There was at first strong opposition to the use of steam engines, but in April, 1834, after much lively dispute in the legislature, a bill was passed authorizing the Canal Commission to place locomotives and cars on this road.

During the next ten years there was a mixed traffic of public and private cars hauled by horses or by steam engines. This produced much confusion and delay. A teamster with his horse-car would frequently keep a train-load of people waiting while he watered his horses or ate his dinner. "The independent teamster took great delight in stopping his cars on the main track while he watered his horses, to the great disgust of the steam train delayed by his action." ("History of Pennsylvania Railroad," Vol. I, p. 42.)

In order to avoid the profanity and general confusion produced by this free use of the public railway, the Canal Commission in 1836 established certain regulations by which all steam trains should leave Philadelphia between four and eight in the morning and five and eight in the evening, so that the seven hours or more, both by day and night, could be used by those employing horse power. In 1844 the use of horses for hauling cars on the main track was abolished.

In the early years of this railroad traffic trains did not start at regular times, but whenever sufficient freight or passengers were at hand to warrant the trip. There were no stations or freight depots except such as were supplied by private parties at eating houses and hotels along the route. No telegraph lines assisted in the management of trains, so that if an engine or train got off the track (as frequently happened) there was no way of sending for help except by some neighboring farmer on horseback. The track was poorly built and the rails frequently spread. "During the spring, as the frost came out of the ground, several trains a day were run off the rails. Without telegraph or telephone, block signals, or even headlights to locomotives, it was at that early day of railroading a difficult problem to care for the distressed trains. To enable us to render succor there was kept at each end of the road and at Parkesburg (near the centre) a wrecking car provided with all the necessary appliances for such emergencies. Whenever informed of trouble by a messenger on a farmer's horse, or at night if the 'night line' was an hour behind time, the watchman on duty would notify me of the fact and I would then instruct him to fire up the 'Night Owl' and call out the wrecking party. When all was in readiness we would start out in search of the derelict. Fearing that a train might be met with on the same track upon which our train was moving, I placed two men, fleet of foot, on the bumper of the engine, to alternate in running curves with red lights." ("History of Pennsylvania Railroad," Wilson, p. 31.)

The construction and management of this road at state expense proved to be a very unsatisfactory undertaking.



The Pennsylvania Railroad System.

It was costly, was poorly managed, and led to much political trickery and corruption. Finally the people became tired of the political scandal that resulted, and elected a legislature which sold out the interest of the state in this railroad and in the public works between Harrisburg and Pittsburg, later described as the Portage Railroad, to the Pennsylvania Railroad Company for $7,500,000. When the road was turned over by the state it was in such poor condition that it required large expense for rebuilding and repair.

The chief difficulty in overcoming the mountains between Harrisburg and Pittsburg was in crossing the great Alleghany ridge near the present city of Altoona. The Juniata River, the chief western branch of the Susquehanna, cutting its way through the numerous ridges, furnished a deep passageway for a canal to the eastern foot of these mountains. On the western side, opposite the Juniata, the Conemaugh had scoured out another deep valley, furnishing a canal route to the Alleghany River and Pittsburg. In early days it was thought that a canal could be built across the mountain ridge and connect these two streams by means of a tunnel.

In 1825 a great convention for encouraging canals was held at Harrisburg, and recommended the building of a canal to connect Philadelphia with Pittsburg. Surveys had been made the year before, and it was thought that a canal could be built along the Juniata River, till it reached the central mountain, where a tunnel four and one half miles long, and more than eighteen hundred feet above sea level, would carry the canal through the main ridge and connect with a canal along the Conemaugh River, thus

establishing canal-boat connection between Harrisburg and Pittsburg. Another canal would reach across from Harrisburg to Philadelphia. Later surveys revealed the great difficulty of getting a canal across the mountain ridge at this height, nearly two thousand feet above sea level, due to the expense of tunnelling and of supplying the canal when built with water. In the meantime the idea of a portage railroad across the most difficult part of the mountains was advocated.

Accordingly the legislature of 1826 provided for the construction of the Pennsylvania Canal at the expense of the state and for a probable portage railroad about forty miles in length across the highest and most rugged section of the mountains.

It was not till 1831 that the legislature approved, finally, the plan of building a portage railroad from the Hollidaysburg basin in the canal, over the mountain to the Johnstown basin on the west side. The summit of the mountain where it was crossed by this railroad was 1398 feet above the eastern canal basin, and 1171 feet above the western basin.

The road was to have a double track, with five inclined planes on each side of the mountain summit, and ten nearly horizontal planes or levels between. The entire portage road between the basins was more than thirty-six miles in length. "As most of the way the road was through a dense forest of heavy timber which had to be moved before grading could be commenced, and as the timber was difficult to burn and too expensive to remove on account of its great size, the work progressed slowly."

The first track on the Portage Railroad was completed

and cars were put in operation March 18, 1834. By the middle of April eighty cars were in operation on this road, but they could not handle all the business offered. On the levels the cars were hauled by horses, but on the steep inclined planes, stationary engines were used with long heavy ropes attached to the cars.

Since any one who could furnish a car was allowed to use the tracks, much delay and confusion were caused, as in the earlier road from Philadelphia to Columbia. Some teamsters wished to travel slowly, others more rapidly, but all were kept to the pace of the car leading the column. Because of these delays, the Canal Commission was compelled to make rules for the regular movement of trains at uniform speed.

In 1835 the second track was completed, so that trains could run both ways without interruption. As soon as the road was opened the cost of transporting a ton of goods from Hollidaysburg to Blairsville (fifty-three miles over the mountains) fell from twelve and sixteen dollars to four dollars per ton. The completion of this portage railroad was regarded as one of the greatest achievements in transportation.

"In October, 1834, this portage was actually the means of connecting the waters of eastern Pennsylvania with those of the Mississippi Valley. Jesse Cheesman, from the Lackawanna River, loaded his boat, named the *Hit and Miss*, with his wife, children, beds and family accommodations, pigeons and other live stock, and started for Illinois. At Hollidaysburg, where he expected to sell his boat, it was suggested by Mr. Dougherty, of the Reliance Transportation line, that the whole concern could

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be safely hoisted over the mountain and set afloat again in the canal. Mr. Dougherty prepared a railroad car calculated to bear the novel burden. The boat was taken from its proper element and placed on wheels, and under the superintendence of Major C. Williams the boat and cargo at noon on the same day began their progress over the rugged Allegheny. All this was done without disturbing the family arrangements of cooking, sleeping, etc. They rested at night on the top of the mountains, like Noah's ark on Ararat, and descended the next morning into the valley of the Mississippi and sailed for St. Louis." ("History of the Pennsylvania Railroad Company," Vol. I, p. 131.)

Charles Dickens, in 1842, describes his journey over this portage railroad as follows: "It was very pretty, travelling thus at a rapid rate along the heights of the mountains in a keen wind, to look down into the valley full of light and softness; catching glimpses through the tree tops of scattered cabins; children running to the doors, dogs bursting out to bark, whom we could see without hearing; terrified pigs scampering homeward; families sitting out in their rustic gardens; cows gazing upward with stupid indifference; men in their shirt sleeves looking in at their unfinished houses, planning out to-morrow's work; and we riding onward, high above them like a whirlwind."

"The highest point in the Allegheny Portage Railroad was 2326 feet above mean tide. Total cost of the road up to January 1, 1837, was $1,634,357.69. Length 36 miles. Length of longest plane (incline) was 3116 feet, overcoming an elevation of 307.60 feet. The time consumed

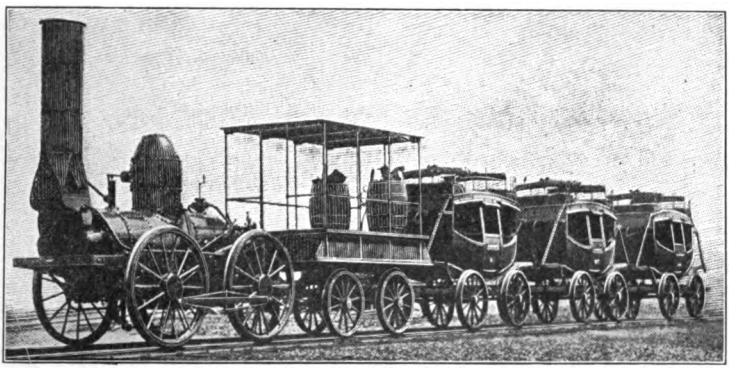
in moving a draught of three cars up or down was five minutes. It required two and a half minutes to attach the cars to the rope. This allowed eight draughts, aggregating 72 tons per hour, passing the plane.

"In the winter of 1851–1852 the Pennsylvania Railroad Company, having purchased from the Commonwealth its passenger cars, passenger trains were for the first time moved over the road at night. While the Old Portage was in full use with its system of planes, its operating involved the necessity of changing power 33 times in 36 miles. To move a section boat over the road from the basin at Johnstown to Hollidaysburg involved calling into use 12 stationary engines, 12 different teams of horses, and 9 locomotives. The minimum number of men to handle this was 12 engineers and 12 firemen at the stationary engines, 9 engineers and 9 firemen for the locomotives, and 12 drivers of teams — making 54 persons in all." ("History of Pennsylvania Railroad Company," Vol. I, p. 131.)

Canal boats in sections were often carried on specially constructed trucks over this road. Eighteen sets of such trucks for the purpose of hauling section boats were put in service by the state, and the report for the year 1843 was as follows: "The section boats paid over one-third of the tolls received on through freight during the year at the Pittsburg office."

The Portage Railroad was of course an expensive and cumbersome mode of crossing the mountain, and surveys were made to avoid the planes and reduce the grades. In 1847 the Pennsylvania Railroad also began to build its great trunk line to connect Philadelphia and Harrisburg

with Pittsburg. It made use of the Portage Railroad while building and completing its own lines, but as soon as its main line was completed it withdrew its strong support from the Portage Road, and as the latter could not compete with the superior advantages of the Pennsylvania lines, the state in 1857 sold out the Portage Road to the Pennsylvania Railroad Company. It was used for a short time and then abandoned, as it did not pay expenses, the traffic being transferred to the Pennsylvania lines across the mountains.



The "De Witt Clinton" and Coaches.

From 1847 on, the enterprise of railroad building between Pittsburg and the Portage Road was carried rapidly forward. The mountain division of the road just west of Altoona required the most skilful engineering. Heavy rock cuttings were made, but the tunnel at the summit was the most difficult of all. Its length was 3612 feet. "It was driven from both ends and from three working

shafts. At the middle shaft the water was so abundant that an engine of eighteen horse-power, which was erected to carry the water away, was found insufficient, and a fifty horse-power lifting and pumping engine had to be substituted. A four-foot vein of coal was found in the tunnel, which with fire clay and perishable shales furnished a roof of very treacherous character. On account of its loose and crumbling materials the whole tunnel had, in time, to be arched in with brick and stone. The tunnel when completed cost about half a million dollars."

With the final completion of the mountain division, the fast train reached Pittsburg from Philadelphia in thirteen hours, and the great traffic route between Pittsburg and Philadelphia was thus finally opened.

The distance between Philadelphia and Pittsburg is three hundred and fifty-four miles, and this stretch of railroad constitutes the main line upon which the Pennsylvania system has been built up.

This part of the road has been greatly improved, as will be shown later, so as to keep up with the rapidly growing demands of traffic between the East and the West. But before describing these betterments in the main line, we will speak of the large and important extension of the system to the east and west, as well as by branch lines to the north and south.

The main outlet for the commerce of the United States toward Europe is New York City, and the Pennsylvania Railroad was compelled to extend its lines to this great centre so as to secure the through traffic from Ohio to the Atlantic and Europe. In 1871 the Pennsylvania Company obtained control of the United Railroads of New Jersey,

agreeing to pay a ten per cent annual dividend on its stock, and at this large price secure its own entrance to New York City. "The connection of Philadelphia by way of the Delaware River bridge with the West Jersey Seashore system was provided at a cost of more than two and a half millions." (F. Spearman.)

In 1869 the Pennsylvania Company took under its control that great system of roads known as "Lines west of Pittsburg," which since then have been a part of the Pennsylvania system, and enable this company to haul goods on its own lines from St. Louis, Chicago, Cincinnati, Cleveland, and many other large cities of Ohio, Indiana, and Illinois, direct to Philadelphia and New York.

In addition to these great and important extensions of its original system, one may quickly see by an examination of the Pennsylvania Railroad map that this company has brought under its management a large number of branch lines, both north and south, such as the Philadelphia, Baltimore, and Washington; the Northern Central, reaching from Baltimore to Lake Ontario; the Allegheny Valley, from Pittsburg to Buffalo; the Monongahela Valley; the Cleveland and Pittsburg; the Grand Rapids and Indiana, reaching to the Straits of Mackinaw; and two or three score of other lines which are good feeders to the main trunk of the Pennsylvania system. By a study of this great map of a single railroad system, one may see what the chief purposes of such a traffic route are in the collecting and forwarding of enormous quantities of freight and millions of passengers. One can scarcely conceive of the enormous bulk and variety of freight carried in a single day by such a railroad; the coal and iron; the wheat and

corn; the dry goods and varied merchandise; the cattle and live stock; the fruit and vegetables; the oil and lumber; the iron and copper ore; the anthracite and tobacco; the oysters and canned goods; the salt and limestone; the milk and dairy products; steel constructions, armor plate and machinery; the wine and beer; the books and newspapers; and the thousand manufactured products shipped westward from the Atlantic states and from Europe.

The managers of the Pennsylvania Railroad have great difficulty in making such improvements as are necessary from time to time to enable it to handle successfully the vast quantity of freight which its central position and advantages naturally supply. It has been a hard task to find cars and tracks and employees enough to handle the ever increasing quantity of tonnage, which keeps pouring toward the Pennsylvania lines. For these reasons we may see that this company has spent vast sums of money in great schemes of improvement, some of which we may describe with a little more detail.

A location on the map of the chief cities of the Pennsylvania system will show that it includes nearly all the important places north of the Ohio and Potomac and east of the Mississippi.

One important betterment is the shortening of the road by taking out the curves and levelling the tracks, by reducing steep grades and bringing long stretches of track as nearly as possible to a level. In passing through the mountains, tunnels have been cut through projecting ridges, shortening distances and removing curves.

From Trenton a short-cut, double track was built westward, which, leaving Philadelphia to one side, strikes the

main line twenty-five miles west of Philadelphia, thus shortening the distance for through freight between New York and Pittsburg. To avoid delays in passing through the big and crowded yards of great cities, short-cut tracks are built, by which cities like Harrisburg, Pittsburg, and Altoona are left to one side, and through freight is not delayed.

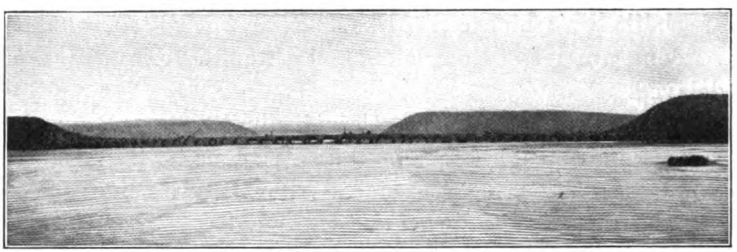
Instead of the one track originally built across Pennsylvania and through the mountains, the main line is now completing four tracks, besides duplicating its lines with double tracks for short cuts as above described. This enlargement and improvement of the road for four tracks has entailed vast expense for road bed, bridges, tunnels, and sidings. For fifty years the Pennsylvania Railroad has been growing like a boy of fourteen, and its old clothes have been found constantly too small.

In many of the cities through which its lines pass it has been necessary to elevate the tracks to avoid road crossings and to enable trains to make full speed through such towns without danger to human life. Such track elevation is one of the most expensive outlays in railroad improvement and costs many millions of dollars.

The new four-track bridges across the Delaware at Trenton and across the Susquehanna above Harrisburg are as solid and permanent as the hills, and are an index of costly expense in improvements. The steady improvement of the road with rock ballast, with larger and larger steel rails, and the building of iron bridges and culverts, are great items, also, in these betterments.

But some of the heaviest items of expense have not yet been mentioned. In the great cities like Pittsburg, Phila-

delphia, Cleveland, and Chicago, it has been necessary not only to elevate or lower the tracks, but to supply much larger yard room for tracks and cars. In recent years



Bridge across the Susquehanna.

what are called "terminal facilities" in the cities have become all-important. Pittsburg has tracks sufficient for sixty thousand freight cars, and needs them all. But it is very expensive to find room in the heart of great cities for such extensive yards, especially in Pittsburg, where the valleys are narrow, and the high bluffs encroach upon the town and river.

Some years ago it was customary to store grain in the great elevators, but now it is transferred to trains, and the number of loaded cars in the yards is enormous. At certain seasons there is a great accumulation of freight, as of grain and live stock in the fall, and coal in winter. This increase in the number of cars and the concentration of enormous traffic in great cities has made such a demand for increased yard room and trackage that the companies, even at large expense, have scarcely been able to keep up with the demand. A few years ago the flood of traffic centring at Pittsburg suddenly increased so much that

it completely swamped the facilities of the railroad and paralyzed traffic.

In the great ports like Philadelphia, the Pennsylvania Railroad owns a large number of freight stations and wharves, all of which are directly connected with its main lines. Hundreds of miles of track are owned by the Pennsylvania Company, by which it reaches all these points. There are twenty-four freight depots distributed throughout the city of Philadelphia, by means of which it is able to deliver goods to points convenient to merchants in all parts of the city.

It would be confusing to enumerate the number of great wharves along the river owned by this company, where it delivers or receives goods for all parts of the world: special wharves for coal, for tropical fruits, for lumber, for dry goods, for petroleum, for explosives, for sugar, for oysters, for hides and leather, for steel goods and machinery, for passengers coming from Europe or South America, etc.

The heaviest passenger traffic in the United States is on the Pennsylvania lines between New York City, Philadelphia, and Washington. This part of the road has been straightened, levelled, four-tracked, and ballasted, so that fast trains in quick succession carry thousands of passengers daily in each direction. Solid stone bridges have been built and tracks elevated through Elizabeth, Newark, and other towns so as to allow swift and safe service.

Between Philadelphia and Pittsburg and on to Chicago, first-class passenger service with the best-equipped fast trains is provided. The importance of the passenger service on all the Pennsylvania lines is measured by the fact

that one-sixth of all the passengers carried on our railroads are found on Pennsylvania trains.

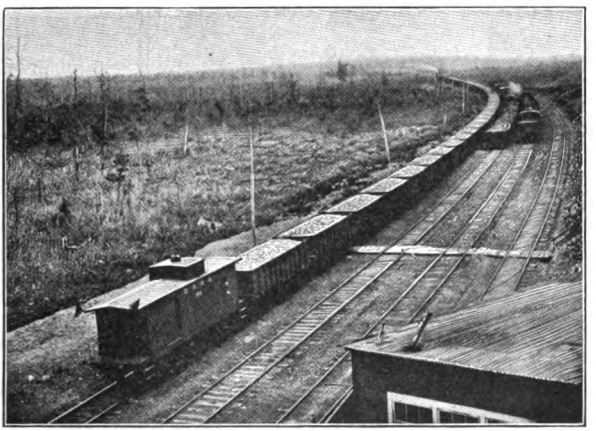
The freight traffic is still more important. In 1903 the tonnage carried by Pennsylvania lines was one-fourth of the tonnage of all American railroads. This is explained in part by the fact that Pittsburg, whose traffic is largely in the hands of the Pennsylvania Company, is by far the largest centre of freight traffic in the United States. Coal and iron ore and steel products pour in and out of Pittsburg daily in thousands of car loads. During the winter months, when the coal trade is heaviest, the capacity of this great road in engines and cars is tested to the full extent. Climbing over the Alleghanies in the face of fierce winter storms, with long trains of heavily loaded coal cars, calls for the gigantic strength of the greatest locomotives. Only about sixty per cent of their registered power can be made available in such weather.

At Jersey City, opposite New York, the Pennsylvania Road has also its huge station and docks, and a fleet of great ferry boats by which it transfers its thousands of passengers to 23d Street, Cortlandt Street, and Desbrosses Street in New York.

Finally the largest undertaking of the Pennsylvania Company, upon which it is now engaged, is the putting of great tunnels under the Hudson River so as to open a large central depot in the middle of New York City, and extend these tunnels farther under New York and the East River to Brooklyn, there to connect with its own lines stretching the whole length of Long Island. Such large undertakings and the enormous expense connected with them explain better perhaps than anything else the over-

whelming demands of commerce in New York, Philadelphia, and Pittsburg, and also the energy of great managers in satisfying these demands.

How a great railroad system supplies itself with engines and cars, and keeps them well equipped is worth considering. The chief point where the Pennsylvania shops are located is Altoona, close to the high crest of the Alleghany Plateau. Here repairs are made and engines built. One



Railroad Train.

roundhouse in Altoona takes care of 250 locomotives daily, and another 300. The Altoona plant has shopped and repaired 148 engines in a single month. These extensive shops for building and repairing engines are equipped with the best iron and steel working machines, electrical engines, furnaces, and machines for planing, drilling, and turning in steel, boiler-making equipment, and the most

skilful engineers and workers in metals. One of the shops turns out five new locomotives a week. The number of freight and passenger cars, besides express and baggage cars, required is almost beyond imagining, 215,000 freight cars being used on the main lines.

If all the men employed in the work of this company were brought together at one place, it would make a large army of 153,000; and if they lived all together with their families in one place, they would form a city larger than St. Louis or Boston. All along its 10,000 miles of tracks are scattered the groups of section hands. In its thousands of towns and stations are the local agents and telegraph operators. On its numberless trains are the trained engineers, conductors, and firemen. In its machine shops are the thousands of skilled workmen; in the great freight yards of the cities are the watchmen, switchmen, gatekeepers, and freight handlers. In its expensive offices in the cities are the bookkeepers and clerks, the train despatchers, and managers, and in addition to all this are the hundreds, perhaps thousands, of men under skilled engineers, who are rebuilding or extending tracks, constructing bridges, and making the improvements which a large railroad system constantly requires.

All these men need to be thoroughly trained and educated for this work. No drunken or careless men can be allowed in the service of the company. They must be intelligent, efficient, and absolutely reliable, or great dangers and losses both to the company and to the public will follow. The whole problem of training its men to the skilful and accurate performance of their special duties is one of the most important factors in good railroad management.

The Pennsylvania Railroad has the reputation of dealing liberally and wisely with its employees. It has tried to train them from early years so that they will be expert and loyal, and remain permanently at their posts in its service.

For the assistance and encouragement of its employees this company has established a system of life insurance, and protection also against accident or disease. The company pays the cost of managing this insurance and makes it thoroughly reliable by supporting it with its full financial resources. This renders it more reliable and less expensive than usual forms of insurance. A pension system for aged employees has also been established. "The distinctive feature of this broadly conceived Pennsylvania Railroad Pension Fund is that the employee contributes nothing to it except his years of faithful service to the railroad. The company pays the pension, without a tax or contribution of any sort from its employees, and rejoices to-day in one pensioner on its roll of honor ninety years old. Boys and men are made to feel, when they enter the service of the company, that they become a part of it; but if they will train themselves to coöperate with others, they may participate fully and personally in the company's success; and that after a career of faithful service every man from the president down to the laborer will receive — not as a charity — but as a gratuity — his life pension." (Frank Spearman, "Strategy of Great Railroads.")

In order to encourage employees in saving their earnings, the company has also established a savings bank, arranged so that at every small station the employee may deposit his money with the station agent and receive three

and one half per cent interest upon it. These savings banks are especially designed for those who are so situated as to have no safe place to deposit their money. "The aggregate deposits since 1887 exceed ten millions of dollars, and since that time more than one million dollars of interest have been allowed to Pennsylvania Railroad workers by the Savings Fund Trustees."

The general management of the Pennsylvania system is in the hands of its officers and directors, whose headquarters are at the great passenger station on Broad Street, Philadelphia. The wise and progressive management of such an immense business has called forth the best talent of great administrators, financiers, and civil engineers. The capital stock of this company amounts to several hundreds of millions of dollars, and it is above all things desirable that the business affairs of the company be wisely managed so that the thousands of stockholders may receive a fair return on their investments (dividends), and so that the millions of people who travel or ship goods upon these lines may be safe from injury and well served.[1]

The work of the general office is divided into several heads and the management of each placed under an experienced and capable leader: as the department of traffic, of finances, of operation, of engineering, and others. A great railroad has a legal department which employs the ablest lawyers to look after its vast legal business. For it has constantly on hand a host of legal problems and cases

[1] On Jan. 1, 1905, the total liabilities of the Pennsylvania Railroad east of Pittsburg were $504,254,138.47. The total liabilities of the Pennsylvania lines west of Pittsburg were $315,670,441. The total for the entire Pennsylvania system was how much? — Poor's Manual.

in the courts to be looked after. A strict account must be kept of all the running expenses, cost of improvements and repairs, salaries and service of employees, losses, and a thousand other necessary expenses. The income likewise from passenger and freight traffic, and from all sources, must be accounted for, and if the affairs of the road are well managed, the balance sheet will show a profit above all expenses which can be distributed to the stockholders. In spite of its vast schemes of improvement, and the costly enlargements of the system as a whole, this company has for sixty years paid a regular yearly dividend to its stockholders.

Such a railroad system as that of the Pennsylvania Company has important relations to the towns and cities through which it passes, to the state, as Pennsylvania or Ohio, and to the national government. We have already described the important agency of the government of Pennsylvania in first chartering this company, and in actually constructing and operating the road till its rights were bought up by the Pennsylvania Company.

But the government of Pennsylvania has always had much influence upon the affairs of the company, first by granting the charter under which it operates, and secondly by various laws to regulate its business. Passenger rates, for example, are determined by state law, and in every session of the legislature laws are introduced bearing upon the business of the railroads. For this reason it is necessary that such a company keep its representatives at the state capital to look after its interests. This has sometimes led to the scandals of what is known as the railroad lobby.

In the same way the Congress at Washington has made frequent efforts to regulate the business of railroads, for example by requiring the use of the automatic coupler so as to prevent loss of life. For several years the national government has attempted through the Interstate Commerce Commission to regulate freight rates so as to prevent unfair discrimination between shippers. During the last year the National government has made more determined and successful efforts to equalize freight rates to shippers. These great companies have been required by law to publish a full statement of their business, income and expenses, so that the public can judge of their condition and management.

In cities, the city councils also have had a large influence upon the affairs of the road. The elevation of tracks in cities so as to avoid the dreadful accidents and loss of life at grade crossings, has been often required by city councils, although it costs the road millions of dollars.

These various relations of a railroad to city councils, to state legislatures, and to the national Congress and government make the management of a great railroad system, extending through many states and cities, very complicated.

The government of the United States also makes contracts with the Pennsylvania line for carrying the mails. The company enters into agreements with the great express companies for express cars, and with the Pullman Company and other car companies for the use of sleeping cars, refrigerator cars, etc.

But the relation of a railroad company to the business world is more important and complicated still. The Pennsylvania Railroad Company is designed to serve the

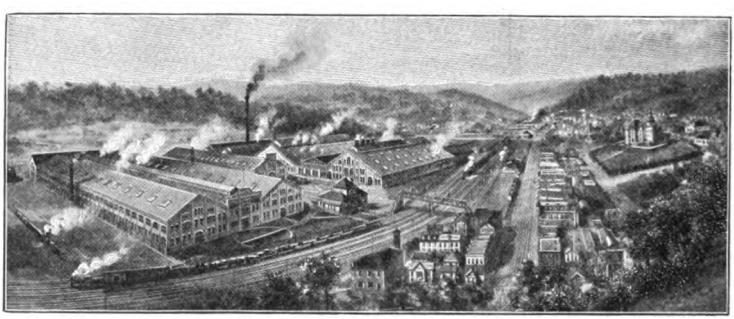
multitude of farmers, mining companies, manufacturers, and merchants who ship over its lines. It should treat them all fairly, and, as nearly as possible, alike. But large companies which do an immense business sometimes desire special privileges and cheaper rates, and this may prove disastrous to rivals or to the business of small manufacturers or shippers.

The Pennsylvania Railroad Company must make freight terms with the great coal companies, with the Standard Oil Company, with the big steel and iron manufacturers of Pittsburg, with the great packing houses of Chicago and elsewhere, with the big lumber companies on the lakes and in the mountains, and with hundreds of factories and mills and merchants throughout its territory. A big railroad, by raising or lowering its freight charges, may bring prosperity or ruin to manufacturers or merchants in cities. For this reason many people have demanded that the government should regulate the tariffs on railroads so as to secure equality and fair dealing to all shippers. There seems to be great necessity for government interference in regulating freight rates so as to secure a free and fair opportunity to all who wish to use the railroads.

The Pennsylvania Railroad has been foremost in this country in making use of the improvements and inventions which the rapid development of railroads has stimulated. It is not easy to keep track of the more important inventions which have revolutionized this traffic.

The improvement in the steam engine since the first locomotives were placed on the line between Philadelphia and Harrisburg in 1834 has been marvellous. The histori-

cal collection of engines at the World's Fairs in Chicago and St. Louis gave striking illustration of this wonderful growth of the power and utility of locomotives. From the crude and clumsy little machines of seventy years ago to the huge and powerful passenger and freight engines of the present is involved a marvellous chapter of rapid transitions. One not closely acquainted with this history of the locomotive engine does not realize how much labor and ingenuity have been spent in perfecting engines. In 1858 the patent office reports show that there were one hundred and sixty-four inventions for the improvement in railroads and railroad cars, but the chief improvements have been made since 1860.



Westinghouse Works, Pennsylvania Railroad.

We can call attention to only a few of the more striking inventions, such as the automatic car couplers, which have greatly reduced the number of fatal accidents among brakemen; the Westinghouse air brakes, which are controlled instantly by the engineer in his cab, and bring a fast train to a stop in a few hundred feet, where the old-

fashioned brakes required as many thousand feet; the block system of running a succession of trains; the interlocking switches which make collisions very difficult; the electric lighting and heating of cars, the vestibuled trains, the arrangements and equipment of sleeping cars, dining cars, observation and parlor cars, the refrigerator and fruit cars, the steel gondolas and other self-dumping coal and ore cars, the speedy methods of supplying engines with fuel, water, and sand — these are but a few of the great and valuable improvements in railroading.

But discoveries, inventions in steel production, such as the Bessemer process and the open-hearth furnace, by cheapening the production of steel rails and steel construction for bridges and engines, have had a powerful influence in increasing railroad building. In the boring of tunnels through the mountains and in building road-beds and curves, a multitude of useful inventions has been applied. In the construction of bridges, new plans and processes of steel construction, of making cement piers and caissons for laying foundations in river beds have been utilized.

The telegraph which stands in the closest relation to railroad management has a great series of marvellous improvements. It would be tedious to enumerate even the more important of these great inventions. It is enough to see that a great railroad company must be up to date, must make use of the best of these inventions, even though it often demands the throwing into the waste heap or scrap-pile thousands of dollars' worth of old machines. It must also educate its men to the skilful use of the new machines and processes. In railroading, one can never be satisfied

with the present, but must be always ready for costly improvements.

The following summary of the condition of the Pennsylvania System is given in Poor's Manual up to Jan. 1, 1905. The length of the lines east of Pittsburg was 5882 miles, west of Pittsburg 4739. The total track mileage was 20545 miles. The equipment was 5327 engines, 210970 freight cars, 5181 passenger, baggage, and dining cars.

Since 1856 the Pennsylvania Company has paid cash dividends in every calendar year. The average yearly rate of dividend the past 47 years is over 7 % and has resulted in the disbursement of $223,000,000.

It should be remembered that a railroad system like the Pennsylvania, although it possesses great natural advantages and a central position, must compete for its traffic with other great railroad systems of the country. The New York Central, for example, and the Baltimore and Ohio share with the Pennsylvania lines the traffic of Chicago, Cincinnati, St. Louis, Cleveland, and a score of other great cities. Even the immense tonnage of Pittsburg is divided up among three or four great roads, including the Wabash, which has lately made good its entrance into Pittsburg, and by its extension to Baltimore and Washington threatens to be a dangerous rival of the Pennsylvania system. It is this rivalry among great progressive systems that makes it necessary to keep up a first-class equipment, to adopt new improvements, and to show the greatest efficiency and safety in handling freight and passengers.

In comparing the Pennsylvania system with other leading railroads which cross the Alleghany Mountains and

connect the great central West with the Atlantic seaboard, we notice that the Pennsylvania has rivals both to the north and south of it. First of all is the New York Central and its associated lines. It has advantages equal if not superior to those of the Pennsylvania. By following the Hudson River and the Mohawk Valley westward to Buffalo, the New York Central avoids the mountains entirely, and has no heavy grades nor mountain engineering, but a level stretch of track by which heavy freight and passenger trains move both eastward and westward with great ease. Again at Buffalo and other lake cities the New York Central taps the immense commerce of the Great Lakes and the Northwest, including the trade of Cleveland, Detroit, Chicago, Milwaukee, Duluth, and a score of other large cities.

The New York Central and its connections surpass the Pennsylvania lines with twelve thousand miles of roadbed; its main trunk line has six tracks, and its terminals, stations, and yards at New York, Albany, Buffalo, Chicago, and other cities are of immense value. An examination of the map of the New York Central will show what a powerful hold it has upon New York State, lower Canada, Michigan, Indiana, Illinois, Ohio, Massachusetts, and parts of other states. It has been said that New York Central lines and their direct connections include territory in which half the people of the United States live.

South of the Pennsylvania lines two great railroads cross the Appalachians, — the Baltimore and Ohio, and the Chesapeake and Ohio. Each of these has more than seven miles of tunnels in crossing the mountains, dis-

UNIVERSITY OF CALIFORNIA

plays great feats of engineering and passes through striking mountain scenery. A trip over the Chesapeake and Ohio along the New River is one of the most varied and attractive in America from a scenic point of view. These roads also connect Baltimore, Norfolk, Richmond, and Washington with Pittsburg, Cincinnati, Louisville, and St. Louis, and many other important cities of the middle West, and carry a large share of the freight between the East and the Mississippi Valley.

In connection with the Appalachian Mountains, we observe that there are two great railroads running southward, the one along the Piedmont belt just east of the mountains, the Southern Railway, and the other down through the Great Valley and connecting with the important cities of the South, such as Atlanta, Savannah, Jacksonville, Birmingham, Chattanooga, and New Orleans.[1]

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[1] It is easy to obtain folders of all these large railroad systems with excellent maps showing the location of cities, the territories covered, and the advantages of each great system for traffic.

THE FIRST PACIFIC RAILROAD

THE building of the first railroad across the Rocky Mountains was a project which aroused great interest and enthusiasm both in Congress and among the people. In 1853 Congress made its first appropriation of $150,000 for exploring and surveying with the purpose of finding the best route for a railroad to the Pacific. Every year the subject was before Congress and was much discussed in the newspapers. The discovery of gold in California, and the rapid settlement of the country, increased the demand for a railroad across the mountains. But before the Civil War the northern and southern representatives in Congress could not agree upon a route, the southern people desiring a southern route with Memphis or St. Louis as a terminal, and the northern, one farther north with Chicago as its eastern point.

With the outbreak of the war, the southern opposition disappeared, and in 1862 a bill for the construction of a railroad across the plains and mountains to California was passed and a company was organized to undertake the work according to the grant of Congress. This was the first time the national government had undertaken to assist the building of railroads on a large scale; but private companies would not venture upon so large an enterprise, and it was felt by the North that such a road would strengthen the Union by binding California and the West more closely to the Northern states.

The eastern terminus, according to the act of Congress, was to be at Council Bluffs, near Omaha, and San Francisco was to be the western limit. In 1864 Congress passed a second bill, granting more liberal terms to those who should undertake the construction of the road. The government itself did not build the road; it was built by companies which it authorized.

The Union Pacific Company, operating from Omaha westward, and the Central Pacific Company, working eastward from Sacramento, were incorporated by act of Congress, and granted the right of way. The companies were to receive the alternate sections in a strip of land twenty miles wide on each side of the road, in all, the total land grant being about 66,000,000 acres, equivalent to a strip of land twenty miles wide, the whole length of the road. Upon the completion of a given section of the road, the government issued bonds of the United States to the amount of $16,000 for each mile ($48,000 a mile for the more difficult stretches through the mountains, and $32,000 a mile for the plateau region between the Rocky Mountains and the Sierra Nevada). These bonds were turned over to the officials of the road and sold by them to raise money for further work on the road. The bonds were to be a government mortgage upon the road, to be paid by the companies at the expiration of thirty years, and bearing six per cent interest. In this way the government greatly assisted the companies in this remarkable undertaking.

The work was begun at Omaha in 1863 and moved slowly at first. But when the two great companies, the Union Pacific and the Central Pacific, began to compete

with each other, to see which could build faster, and thus secure more government land, bonds, etc., the work proceeded more rapidly.

The Union Pacific had much difficulty in getting ties and bridge materials for construction. No railroad had yet been completed from Chicago across Iowa, and lumber and ties had to be gathered from the woods along the upper and lower Missouri River. The farther westward the road was built, the longer was the distance from Omaha from which these materials must be hauled. When the construction companies reached the Rocky Mountains, ties and lumber were obtained from the mountain sides, and floated down the streams to the point where they could be used in building the tracks.

Through Nebraska and Wyoming the road followed the Platte River, the old trail to California. The difficulty in crossing the main ridge of the Rocky Mountains was much lessened by finding a low pass, now known as Evans pass, by which easy grades could be built across the range. By November, 1867, the Northwestern Railroad was completed from Chicago to Omaha, and now this road could furnish the Union Pacific the vast quantity of track and bridge material needed in construction.

In crossing the plains much danger was experienced because of Indian attacks. The men had to be organized and equipped with rifles as well as with spades, and United States troops were employed to guard the surveying camps. Several hundred men were killed by the Indians during the progress of the building.

As the work proceeded thousands of men were employed, and it required, daily, loaded trains to supply

the materials needed for construction and the support of the camps. The Union Pacific construction camps pushed across the Black Hills of Wyoming and down into the valley of Green River. The surveyors had been busily at work tracing out the best route from the Green River to Salt Lake.

"Winter caught the builders at the foot of the Wasatch range, but it no longer stayed them. The spirit of the fight had got beyond that, and the frozen earth was dynamited like rock. Track was laid across the Wasatch on a bed covered with snow and ice, and one of General Casement's track-laying trains slid, track and all, off the ice bodily into the ditch! Even the Mormons aroused themselves, and under Brigham Young's exhortation turned mightily into the race. In railroading then, as in politics later, the watchword was 'Claim everything,' and the Central Pacific people astonished the eastern builders by filing a map and plans for building as far east as Echo, some distance east of Ogden.

"The two companies had twenty thousand men at work. The Casement brothers of the Union Pacific construction forces rose to the occasion. Eastern papers were carrying daily headlines, 'The Union Pacific built — miles to-day.' In the beginning a mile a day was considered good work, but the Casements had long been laying two miles a day, and now were working seven days in the week, and every hour the light gave them, and they crowned their supreme efforts by laying in one day nearly eight miles of track between daylight and dark.

"The Central Pacific meantime stayed not for stake and stopped not for stone. They had fourteen tunnels to

build, but they did not wait to finish them. Supplies, even to engines, were hauled over the Sierras, and the work was pushed until, in the spring of 1869, the opposing tracklayers finally met at Promontory, Utah; the moment at which the law had declared a junction must be made, had arrived."

"On May 10th Leland Stanford, governor of California and president of the Central Pacific, and Durant, Duff, and Sidney Dillon, of the Union Pacific, assembled with their friends to drive the spike that was to signalize the completion of the great undertaking. A little company of regular soldiers with a garrison band from Fort Douglas preserved the military atmosphere of the long struggle. The Mormons who had helped so faithfully with the road-bed were there, and the coolies from San Francisco and the Irish tracklayers from the Atlantic seaboard faced each other. Strawbridge and Reed, the rival superintendents of construction, placed under the rails the last tie of California laurel. Spikes of silver and of gold from Montana, Idaho, and Nevada were presented and driven into it, and Dr. Harkness, on behalf of the greatest Pacific state, presented the last spike wrought of California gold." ("The Strategy of Great Railroads," Frank H. Spearman.)

The Central Pacific Company under the management of Leland Stanford, Collis P. Huntington, and other California capitalists had the greater difficulties to overcome. The steep and lofty Sierra Nevada Mountains had to be crossed by a pass much higher than that of the Rocky Mountains. Long lines of snow sheds had to be built to protect the tracks, and tunnels were bored through the mountains. The iron and many other materials used in

construction had to be brought round Cape Horn or across the Isthmus of Panama. But the builders were greatly helped by the cheap Chinese labor furnished on the Pacific coast. Otherwise they could hardly have succeeded.

The length of the road from Omaha to Ogden (the part built by the Union Pacific) was 1042 miles, and is estimated to have cost $60,467,641. Mr. Henry Kirk White estimates that the profit on building it was $5,691,641. If to this be added the value of stocks held by the promoters, the whole profit of the work was about $16,710,432.

The completion of this road, opening a transcontinental line from New York to San Francisco, produced great enthusiasm throughout the country, and was regarded as one of the greatest achievements in American history. It greatly stimulated immigration into the West, and led to the development of western industries and cities.

An examination of the railroad map of the United States at the present time will show at least four other transcontinental railroad routes. These are the Northern Pacific, the Great Northern, the Santa Fé, and the Southern Pacific. But the Union Pacific occupies the central position in transcontinental traffic, and its influence upon the settlement and building up of the West has been enormous.

When the Union Pacific was completed to Ogden the government held a mortgage of $27,236,512 against it, and five out of the twenty directors chosen to manage the affairs of the road were to be appointed by the President of the United States. This brought the road during its construction, and for thirty years afterward, under the supervision of the government, and led finally to one

of the greatest financial scandals of our history, known as the "Credit Mobilier" affair.

The affairs of the road did not prosper under such management, with mixed governmental and private control. Congress was constantly being called upon to investigate and regulate its concerns, till finally, in 1893, it fell into the hands of a receiver. After five years' management by receivers, during which the general condition of the road and its equipment grew worse, the road was bought by Mr. Harriman and his associates. He also acquired control of the Central Pacific, and thus had a through line from San Francisco to Omaha.

Under the vigorous management of Mr. Harriman the road was largely rebuilt, its grades levelled, its curves taken out when possible, and tunnels built through the mountains at a lower level. Its road-bed and equipment were brought to a first-class standard. This involved an enormous expense. A few of these striking and expensive improvements may be mentioned in detail.

In order to reduce the grade over the Black Hills to 43 feet to the mile, it was necessary to make at one place "a single fill 900 feet long and 130 feet deep. One cut was made 80 feet deep and 1000 feet long. At the summit of the ridge a tunnel through granite was dug 1800 feet long and 247 feet lower than the old level. To get down the steep western slope with a grade of 43 feet required all the skill of the engineers. Through the Wasatch Range, just east of Salt Lake, it was necessary to bore a tunnel 6000 feet long. But the engineers were astounded to find that there was a shifting of the materials and walls of the tunnel, so that the floors and tracks were warped

and twisted. Twelve by twelve hard pine timbers laid skin to skin in the tunnel were snapped like matches by this mysterious pressure. Engineers are on record as stating that in the Aspen tunnel such construction timbers were broken in different directions, within a length of 4 feet. An engineer stood one day in the tunnel on a solid floor of these timbers, when under him, and for a distance of 200 feet ahead of him, the floor rose, straining and cracking, three feet up into the air. Before the tunnel could be finished it became necessary to line over 700 feet of it with a heavy steel and concrete construction." (Frank H. Spearman, p. 66, of "Strategy of Great Railroads.")

A large part of the Central Pacific from Ogden to San Francisco was rebuilt, curves were straightened out, new tunnels were dug, and to avoid the high rocky ridges and curves just north of Salt Lake the new route was built directly across the north end of Salt Lake, 22 miles through water 30 feet deep.

The Harriman interest bought up also a controlling influence in the Southern Pacific, and finally the Chicago and Alton. An examination of the map which includes the Harriman lines will show that about 17,000 miles of road are owned and operated by this corporation. In three years, Mr. Harriman spent about $100,000,000 in rebuilding and improving these roads.

A comparison of the history of the Union Pacific Railroad with the history of the Pennsylvania lines shows a remarkable similarity. In both cases these great enterprises were undertaken and carried out under state or national supervision. In both cases, serious political and

financial difficulties arose and led to a great scandal. In both cases the roads were finally sold out to private corporations, and then rebuilt and put upon a firm financial and commercial basis.

A comparison of roads in the Rocky Mountain region with those of the East, like the Pennsylvania Railroad and the New York Central, shows that the Western roads have a longer mileage, spread over a sparsely settled country, and with large cities many hundreds of miles apart.

An examination of the railroad map of the United States, such as is given in the large school geographies, shows that in the Atlantic states north of Virginia, and in the North Central states above the Ohio River and westward to Kansas and Nebraska, there is a close network of railroads. In the Southern states the railroads are about half as numerous, while in the western half of the United States they are scattered, and far between. Such a railroad map shows very well the density of population and the amount of business, manufacturing, and commerce carried on by the people.

The description of the Pennsylvania Railroad and of the Union Pacific goes to prove that the many railroads of the United States have been gradually consolidated and organized under a few great corporations, each of which controls many thousands of miles of track, consisting of trunk lines and tributary lines. This consolidation has some great advantages, first by producing much greater economy and unity in the management of roads, and second, by making it possible to transport vast quantities of freight hundreds, and even thousands, of miles over trunk lines without changes and transfers. Fruit trains

can travel from California to Chicago and New York without change of cars. Grain, and cattle, and flour, from Omaha, Kansas City, or Minneapolis, can be shipped to New York or Philadelphia or Baltimore without change. The commerce of the country really demands these long and uninterrupted hauls.

By consulting the tables of the Census Report we see that the number of miles of railway in the United States has increased with wonderful rapidity since 1830, till in 1903 there were 207,186 miles, and that the entire mileage in Europe was only 175,000. In this respect the United States far exceeds any other country, and has indeed nearly as large a mileage as all the other countries put together. The present railroads of the United States would encircle the whole earth more than eight times, and the increase of mileage in the last few years has been much above the average.

The table of accidents showing the number of persons killed or injured by railroads in the United States is startling. In 1903, 9840 people were killed and 76,553 injured on our railroads. In the three days' battle of Gettysburg in 1863, 5664 men were killed on both sides and 27,206 wounded. ("Century War Book," Vol. III.) At this rate two battles of Gettysburg would not kill and maim as many people as our railroads in a single year. In the last three years the number of fatal accidents has increased. This dreadful loss of life should be prevented to large extent by greater precautions in running trains, by abolishing grade crossings, and by more stringent regulation of railroads by the government. Many great railroads have refused or neglected to make necessary improvements until

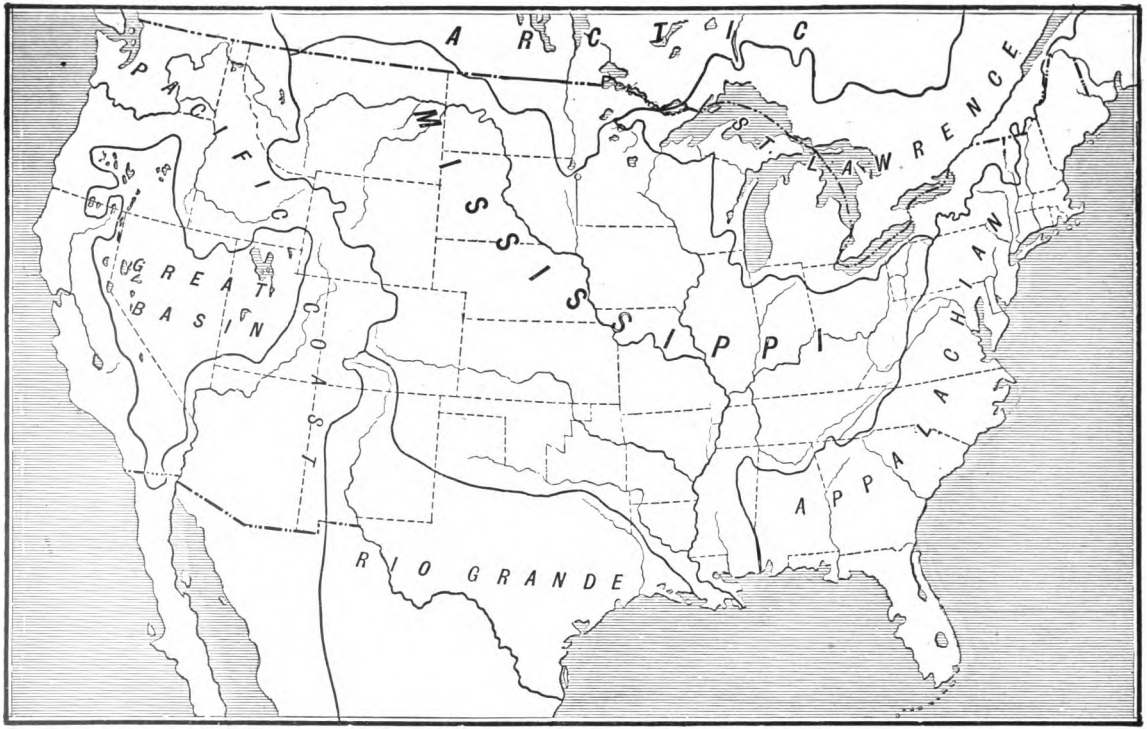
compelled to do so by law, as in the case of the automatic coupler. In the cities, also, the roads have been slow to elevate their tracks and avoid grade crossings till required to do so by city councils. Railroads in Germany and in England, though carrying as many passengers as ours, show nothing like this loss of life in the United States.

THE MISSISSIPPI RIVER

THE valley of the Mississippi spreads far from east to west and from north to south. It is flanked on the east and west by long mountain ranges, which make it difficult to approach from those directions. Because the rain-bearing winds are shut off by the western mountains, and on account of its open exposure to the influences of the Gulf on the south, and of the Arctic regions on the north, the Mississippi Valley, though tolerably level throughout its vast extent, exhibits great variety of climate and products.

For the purposes of our description, it may be separated into four divisions: the Upper Mississippi with its tributary streams to its junction with the Missouri, the Missouri and its branches, the Ohio Valley including the Tennessee and Cumberland rivers, and the Lower Mississippi from Cairo to the Delta. These four regions combined occupy that vast and diversified territory lying between the crests of the Alleghanies and the Rockies, and from north to south between the Great Lakes and the Gulf of Mexico.

The Upper Mississippi takes its rise on a low plateau fifteen hundred feet above sea level, sprinkled with a multitude of small lakes, close to a slight swell of land which separates it from the waters of Hudson Bay. The lakes lie in a wilderness of evergreen woods and tamarack marshes, of low lying hills and ridges left by the northward retreating glacier. This region is the paradise of the fisherman and summer camper. In winter it is the land of snow-



Drainage Areas of the United States.

shoes and lumbering camps. Being but fifteen hundred feet above sea level, in its three thousand miles of descent to the Gulf the river can average a fall of only six inches to the mile. More than half of this descent it makes before reaching St. Paul in Minnesota, and for the rest of its journey it falls only three or four inches to the mile, and this explains why the great river is navigable from the Gulf to the twin cities.

From St. Paul southward the Mississippi is lined with steep bluffs which rise at first but two hundred or three hundred feet above the river, but gradually increase in height till at Winona and La Crosse they stand almost mountain-like six hundred feet above the stream. This part of the river is delightful for summer tourists, who pass slowly up the river's winding course in steamers. The tops and sides of the bluffs are covered with a heavy growth of hardwood forests except where they stand out as bare and precipitous rocks. The cities are built on the higher plains at the foot of the bluffs. The scenery on this part of the river is spread out on a grand scale. Especially along the shores of Lake Pepin, famous in Indian tradition, below Red Wing, where the river widens to a deep lake three miles across and thirty miles in length, and bordered by high forest-covered bluffs, the scenery is striking.

The tops of the bluffs are upon a level with the prairies which stretch westward hundreds of miles in rich fields of grain, pasture, and maize. The rivers which come down to the Mississippi from these prairies must cut long and deep valleys to reach the level of the Mississippi.

The valley of the Mississippi between the bluffs is from

three to seven miles in breadth, with broad bottom lands through which the river current winds in endless curves. At the foot of the bluffs upon either side of the river is a trunk railway line which connects St. Paul and Minneapolis with the river cities southward. The railroads moving westward must climb to the high prairie levels by following the longer tributary river valleys, which furnish a gradual ascent to the upland levels. Between St. Louis and St. Paul each side of the great valley is lined with a railroad nearly the entire distance. The river winds its way southward hundreds of miles, in its great trough, until it passes Grand Tower below St. Louis, at which point it widens out into a broad alluvial valley. Many of the cities, like Dubuque, Davenport, and Quincy, are beautifully located on the high beaches and bluffs which border the valley.

The Wisconsin River, like the Upper Mississippi in Minnesota, rises in the beautiful lake and forest region of northern Wisconsin. In its middle course it has cut deep and narrow gorges, known as the Delles of the Wisconsin, which present great scenic beauty. Near by is the famous Devil's Lake region in a deep valley.

The sources of the Ohio, on the contrary, are in a mountain region extending all the way from western New York to the mountains of North Carolina and Georgia. For the most part it is a high forested region from two thousand to five thousand feet above sea level through which the rivers have worn out deep, winding valleys.

Loftier still, the sources of the Missouri and of other rivers flowing eastward to the Mississippi for a thousand miles along the mountains spring from the rugged sides

of the high Rockies, sometimes even from the foot of the glaciers.

Both in the east and in the west, therefore, the Mississippi Valley rises into high mountain districts, although the western summits are three times the elevation of the eastern. The lower part of the Mississippi is the broad flood plain of these combined rivers.

Physical Conditions and Resources

As a part of the great central plain extending from warm summer seas at the south to broad Arctic waters and ice fields on the north, the Mississippi Valley is more influenced by the Gulf of Mexico and by the Arctic Ocean than by the Pacific and Atlantic.

The high Rocky Mountains, one thousand miles broad, shut out mainly any direct influence from the Pacific Ocean, while the long, low Atlantic Highlands influence somewhat the winds and rains from the Atlantic. But the sweep of winds and rains from the north and from the south is unhindered. The Gulf sends rain-producing winds up through the Mississippi Valley to the Great Lakes and perhaps beyond, and the summer heat advances far into British America, producing a warm short summer far into Canada, and extending the wheat and oats producing regions. On the other hand, winter sweeps down from the north on the wings of the great cyclonic storms, unhindered by any mountain range, and carries the cold blasts sometimes as far as Louisiana and Florida. This situation gives great extremes of climate throughout the Mississippi Valley, but especially in its northern half.

The forest regions of the Mississippi Valley, including the Ohio Valley, and the Lower Mississippi below Cairo, are supplied with an abundant rainfall. A small region at the source of the Mississippi and another on the Lower Missouri in the state of Missouri are forested. The prairie regions include most of the territory drained by the Upper Mississippi and its tributaries and the middle part of the

Cattle feeding on the Great Plains.

Mississippi Valley to about the one hundredth meridian. The prairie regions have sufficient rainfall for the support of forests, but because of prairie fires in the times of Indian occupation, and because of the peculiar black soil of the prairie regions, the forests were long kept down. At the time of the first exploration by white men they were vast stretches of waving grasses and wild flowers, interrupted only by strips of timber near the streams. The great plains or plateaus that extend from the foot of the Rockies eastward for three hundred to four hundred miles are treeless for lack of rain.

This division of the Mississippi Valley into forests, prairies, and arid plains is due mainly to the distribution of

rainfall as controlled by the mountains on either side and the exposure to the Gulf influences on the south.

The leading occupations in these three districts have depended largely upon their natural resources, as lumbering in the forested areas, grain and stock raising on the prairies, and grazing on the plains. But agriculture has extended to all parts of this vast area by removal of the forests in the wooded regions, and by irrigation in arid lands.

The coal deposits, so abundant in several large areas of the Mississippi Valley, were laid down during the early Carboniferous period long ages ago.

The largest coal-field stretches along the western slope of the Alleghany Mountains, from New York State to Alabama, and is almost unlimited in coal supply. The Illinois and Indiana coal-field has about sixty thousand square miles, and the Iowa and Missouri field is nearly of the same size. Scattered deposits are also worked in Colorado, Texas, Dakota, and other states. Coal-mining and the commerce and manufacturing dependent upon the use of coal have been developed in the Mississippi Valley to a remarkable degree when one considers the short time since the coal-fields were discovered and opened.

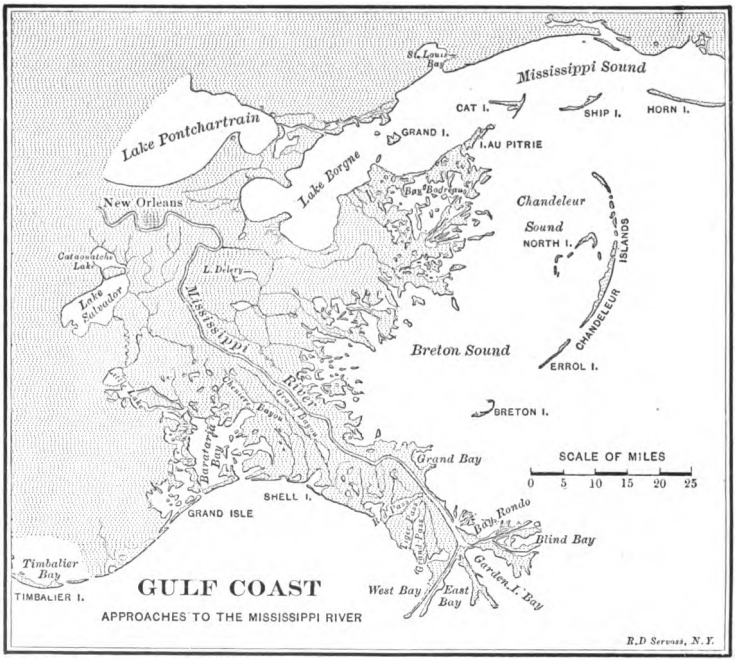
Later than the coal-producing era was the glacial period, which spread the great ice blanket over the northern part of the Mississippi Valley. The ice sheet reached to the present site of Cincinnati and almost to Cairo, Illinois, and covered the whole North with a vast mantle of ice, in places probably a mile in thickness. Its results may still be distinctly traced, not only in the long line of its terminal moraine (an irregular series of hills and ridges extending across Long Island, New Jersey, Pennsylvania, Ohio, Indi-

ana, Illinois, Iowa, and the Dakotas), but also in the deposit of clays, gravels, boulders, and other mixed materials which the glacier brought with it, and scattered over the whole area, sometimes two hundred to three hundred feet deep. Almost the entire surface of the Middle and Northern states was seriously modified by these deposits, rivers were turned out of their courses by the filling up of their old channels, and innumerable lakes were formed behind the embankments of gravel and till which the glacier piled up step by step in its retreat northward. In Minnesota and Wisconsin the ten thousand smaller lakes which the Mississippi and its branches still drain were thus formed by the glacier. The soil of the glaciated regions is that which the ice sheet deposited, enriched by later vegetable mould. It includes a large part of the prairie regions, as well as other districts farther east.

As the great glacier retreated northward the melting waters collected in vast lakes at its southern front, such as the Red River Valley, Lakes Superior, Michigan, and Erie, all of which poured their accumulated waters down the Minnesota, the St. Croix, the Illinois, and the Wabash to the Mississippi. It has been estimated that the melting glacier and the rains at that period supplied ten times as much water to the Mississippi as now flows down its channel, and this vast flood poured itself southward toward the Gulf. The Minnesota is the broad preglacial channel through which the northern lake (Red River Valley) formerly sent its waters. The Upper Mississippi at Minneapolis and above is a recent river developed at the close of the ice age and now forming the Mississippi proper with its narrow, recent gorge below St. Anthony's Falls. This

gorge, reaching down to the junction with the Minnesota, has been produced by the recession of the falls since the glacial period, the same as the Niagara Gorge.

The Lower Mississippi south of Cairo was once an arm of the Gulf, reaching a thousand miles northward. This



Delta of the Mississippi.

projection of the sea was probably a drowned valley like the Chesapeake Bay, produced by the sinking of the land.

But in later ages the Mississippi, carrying a vast quantity of sediment, has silted up this bay to a depth of one

hundred and fifty feet in the north, to still greater depths southward, and has finally built up the delta, even reaching far into the Gulf. Thus has come into being the broad flood plain of the Mississippi, over which the present river winds in huge curves one thousand miles to the sea. There are no rocks in the channel of the Lower Mississippi, but the river flows over a deep bed of these soft river deposits.

From the above statement it is apparent that the present Mississippi Valley, including all tributary streams, with their climate, soil, and natural resources, is the combined product of great forces operating through thousands of years. First were produced the great mountains that lie to the east and west, and second were built up the present lands of the great valley itself.

Occupations

It is not hard to see that the leading industries of the Mississippi Valley studied in our earlier lessons in geography are such as the physical and climatic conditions have imposed. A brief survey of these earlier studies, comprehending the Mississippi Valley as a whole, may be now in place.

Agriculture in this vast region is far in advance of all other industries. In importance and in wealth-producing power it is unrivalled. The prairie regions have been first in productions, and were easily brought under control of the ploughshare. The corn belt of the North Central states, Illinois and Iowa, as its centre, but reaching out into all the neighboring states, stands first in agricultural productiveness. On corn and grass are based

also the raising of cattle, horses, and hogs, and the dairy business. The wheat and small grain belt lies mainly farther north in Minnesota and the Dakotas, and is the basis of the flour milling of Minneapolis, Duluth, and other cities of the Northwest. In the southern part of the Mississippi Valley the cotton crop is by far the chief product (in Mississippi, Louisiana, Texas, and Arkansas). The forests originally abundant in these states have been partly swept away to make room for cotton fields. In Kentucky

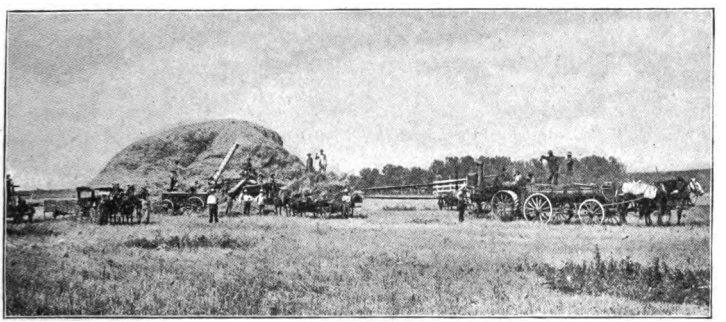
Picking Cotton.

and southern Ohio, tobacco is the foremost agricultural product. Still farther south in Louisiana and Texas lie the sugar-cane belt, along the Gulf, and the rice fields which have recently taken on much importance.

Along the eastern foot of the Rocky Mountains, where the eastward-flowing rivers emerge from their deep, dark cañons to the level plains, is the irrigation belt. Here

agriculture has been extended over a once barren and desert region.

Along the river courses, as the Arkansas and the Platte, the green strips of irrigation have been extended far out across the plains toward Kansas and Nebraska. Some of the large sugar-beet ranches lie in this belt of irrigation along the Arkansas. In a marked degree almost every



Threshing Wheat.

part of the Mississippi Valley has become agriculturally rich and productive. The vast forest stretches which first greeted the pioneers in the Ohio Valley states have been largely cleared away by axe and fire, and now millions of acres which were once shaded by gloomy forests are given to corn, wheat, tobacco, and meadow lands.

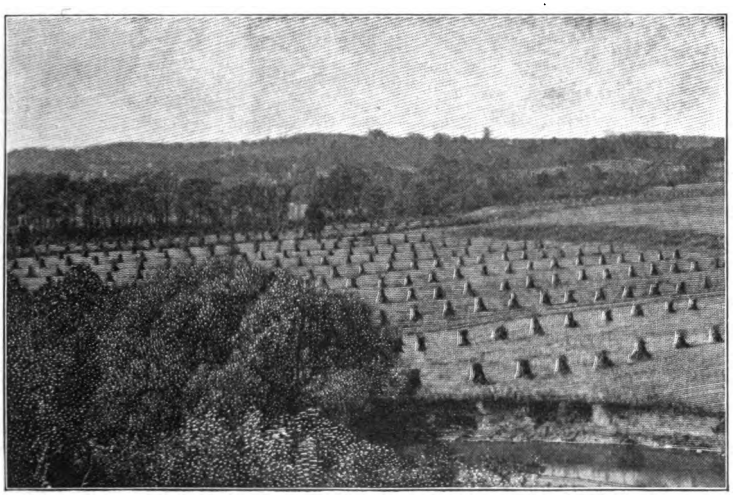
As the early settlers poured over the Alleghany Mountains to occupy the forests and prairies of the Mississippi Valley, they carried with them the primitive tools and modes of agriculture known to the colonies and to Europe for hundreds of years; but when the broad farms of the West, covering hundreds and thousands of acres, called for

immediate conquest, the inventive faculty of the pioneer farmers was set to work to produce labor-saving machines. In the Mississippi Valley, especially, the last hundred years has been marked by a rapid series of great inventions

Tobacco Field.

in agricultural machinery, such as ploughs and cultivators, corn planters and drills, mowers and reapers, threshing machines, corn shellers and corn cutters, ensilage cutters, hay rakes and stackers, ditchers, — in short, a multitude of machines designed to relieve the heavy drudgery of farming

and vastly to increase the product. Under the leadership of the inventive farmers of the Mississippi Valley, the whole world has begun to learn the great lesson of labor-saving machinery as applied to agriculture on a large scale. Large factories, also, for the manufacture of agricultural machin-

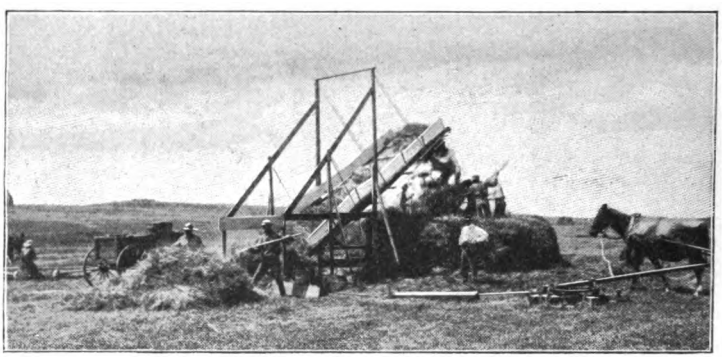


Scene in Ohio.

ery have sprung up in Chicago (Deering and McCormick plants), Indianapolis, St. Louis, and in dozens of other cities. American machines are also shipped over the world to Russia, India, South Africa, and South America, wherever agriculture must compete with the farmers of the United States.

The extensive mining industries of the Mississippi Valley are scarcely less remarkable than its agriculture. For

eight hundred miles along the western Alleghany Plateau, coal-mining has sprung into commanding importance. Western Pennsylvania and eastern Ohio, West Virginia and Kentucky, Tennessee and Alabama, are yearly bringing to the surface many millions of tons of coal. The Illinois and Iowa coal-fields, stretching through many states, are second in present productiveness to the Alleghany coal-fields, while the Upper Arkansas in Colorado supplies the western demand. The importance of this coal production



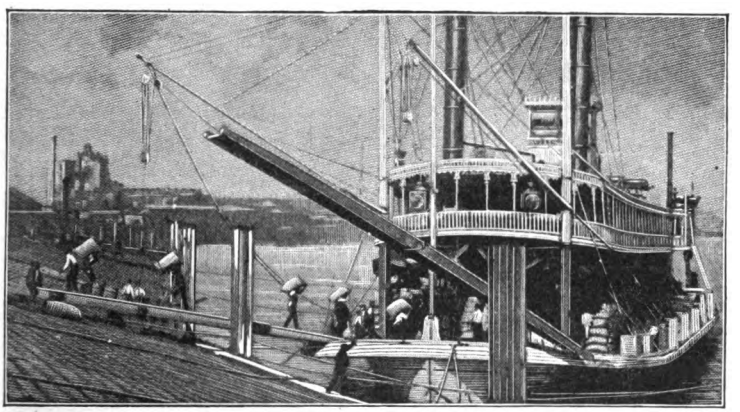
Stacking Hay in Kansas.

to the railroads, steamboats, and iron industries and factories of the Mississippi Valley cannot be easily estimated. At Pittsburg is the largest centre of iron and steel production in the world, wholly dependent upon coal. But along the southern shore of Lake Erie is another series of large iron-producing cities second only to Pittsburg; while Chicago, Chattanooga, and Birmingham are likewise black with the smoke of great furnaces and steel plants.[1]

[1] The oil wells of the Ohio Valley and of the Southwest (Kansas and Texas) have also shown large wealth-producing power.

On the opposite or western rim of the Mississippi Valley, silver and gold are abundantly mined, and the smelters, where the ore from the mountains is reduced, are found at Pueblo, Denver, Great Falls, and other cities lying on the upper streams of the Mississippi basin.

The methods and machinery employed in the mining



Loading a River Steamer.

both of coal and of precious metals have shown a rapid improvement similar to that in agricultural machinery. Great factories have also sprung up for the production of mining machinery. (Steam engines, smelting furnaces, crushing machines.)

To handle the immense products of the Mississippi Valley and bring them to market has taxed the carrying power of our broad rivers and lakes. In the early days (first half of the nineteenth century) the Ohio, Mississippi, and Missouri were the great highways of commerce, and the

building of steamboats and the improvement of river navigation in all parts of the great valley were the most important concerns of the people. The Mississippi and its tributary streams supply about fifteen thousand miles of navigable waters, and some parts of this system of inland waters, as the Monongahela and the Lower Mississippi, are now utilized on a large scale, while the whole is likely in the future to become of immense value to transport.

But the railroad system which has spread its iron network through all the states of the valley is now of chief importance in commerce. The Mississippi Valley as a whole, on account of its generally level surface, has been an easy country in which to build railroads, and the products of this rapidly growing and enormously fertile region have been so great that the railroads have spread themselves swiftly in every direction. In many states scarcely a county can be found without railroads, and a town without a railroad is behind the times. The leading trunk lines of railway extend across the Mississippi Valley from east to west, carrying the products toward the eastern seaboard. From Kansas City, Omaha, and St. Paul train loads of heavy products are sent eastward via St. Louis and Chicago.

The building and equipment of such railways has been a matter of vast expense, and the speed with which it has been accomplished has been a remarkable proof of the wealth and energy of the people. The growth of the iron and steel industry at Pittsburg and many other cities, the great machine shops at Dayton, at Cincinnati, at Pullman near Chicago, and at other cities are a direct result of the

enormous demand for steel rails and railroad equipment. These large factories also turn out many cars, engines, and other equipment for shipment to other countries, as Mexico, Japan, etc.

The shipment of the products of the Upper Mississippi Valley eastward by way of the Great Lakes to Buffalo, New York, and Europe has brought into existence a large fleet of lake steamers, sailing vessels, and barges, which carry on an immense traffic over the lakes during the eight months of open navigation. This, of course, has produced a large shipbuilding industry at the ports of the Great Lakes, at Cleveland, Milwaukee, etc. The trunk railways from Chicago to New York also carry immense quantities of staples.

The transfer across the watershed that separates the Upper Mississippi from the basin of the Great Lakes and the St. Lawrence is so easy, and the elevation so trifling, that we frequently think of Chicago, Cleveland, and the lake cities as being in the Mississippi Valley. To all intents and purposes the Upper Mississippi and the Great Lakes region are one vast plain, and the commercial interchanges between them are so close, easy, and extensive that they may be well classed as one region.

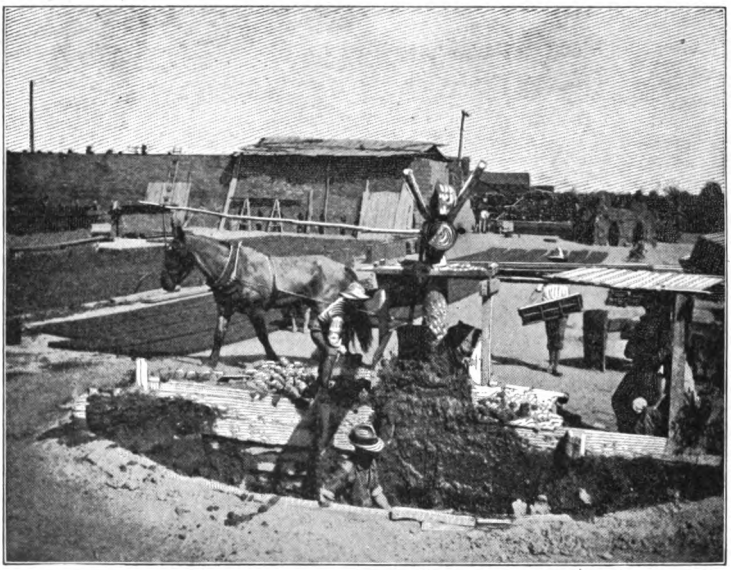
The extensive forests of the Mississippi Valley, along the Alleghany Plateau and throughout the Ohio Valley states, in Minnesota and Wisconsin, and in the states which border the Gulf, as well as in Arkansas and southern Missouri, for one hundred years have been a boundless source of lumber supply, and the support of those great manufacturing industries which are dependent upon lumber, as the building trades, the manufacture of furniture, of wagons,

carriages, ploughs and many other agricultural implements, car factories, ship and steamboat building, etc.

From the above survey it is clear that the manufacturing industries of the Mississippi Valley are those which are the natural result of its abundant raw products. Beef and pork are packed in the extensive packing houses of Omaha, Chicago, Cincinnati, and other cities which are the natural centres for collecting livestock. Blast furnaces and machine shops are important at Pittsburg, Birmingham, Chattanooga, Chicago, and Cleveland, where iron ore and coal can be brought together with least expense. Minneapolis, Milwaukee, and Duluth are the appropriate centres of flour milling, because they are nearest to the wheat fields. Denver, Pueblo, and Great Falls are the natural smelting grounds for the precious ores from the mountains. Tobacco is appropriately worked up at Louisville and Cincinnati. Cotton mills are rapidly springing up in such southern cities as Atlanta and New Orleans, because raw cotton and labor there are cheap and abundant. At New Orleans are large sugar refineries because this city is the shipping centre for the handling of raw sugar. Many cities in the Mississippi Valley, such as Lansing, Nashville, South Bend, Toledo, Chicago, Rockford, Minneapolis, St. Louis, and Moline, have large factories for the manufacture of wagons, furniture, ploughs, reapers, and other agricultural implements, first because the raw materials are near at hand, and second because the market demand among the farmers of the Mississippi Valley is strong and constant for such machines and implements. Throughout the prairie states brick, drain tiles, sewer pipes, and ditching machines are manufactured in extensive

Cotton for Shipping.

establishments, because vast quantities of these clay products are used in building and paving, in draining the prairies and swamps, and in sewer systems of cities and towns. Whiskey is manufactured in vast quantities at

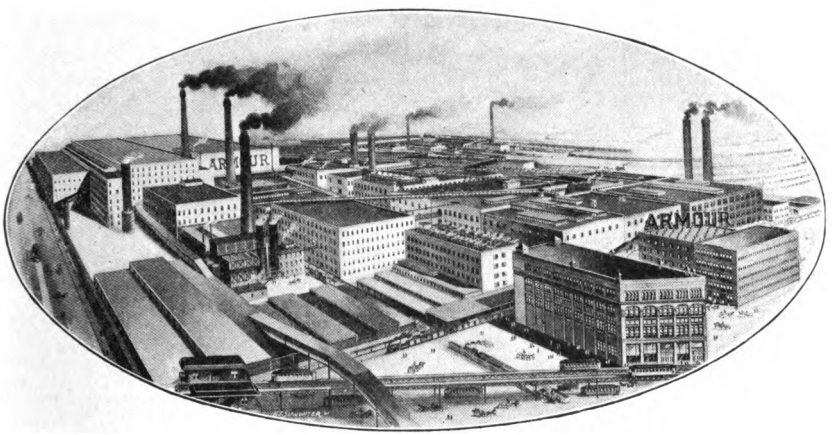


Brickyard in Ohio.

Peoria, Illinois, and beer at Milwaukee, because they have near at hand the grains needed for this industry, and the demand for the products.

In addition to these large manufacturing interests which are the natural outgrowth of the forests, farm products, and mines of the Mississippi Valley, the factory system in many industries has been spreading among the cities of this wealthy and populous region.

Within a few years the state of Ohio, for example, has been changing into a hive of manufacturing industry. Such cities as Dayton (Cash Register Company and car works), Akron (rubber factories), Toledo (glass manu-



Packing House in Kansas City.

factures), East Liverpool (pottery), Lima (oil refining), Columbus (shoes and leather), are examples of the rapid spread of manufacturing. St. Louis and Cincinnati have become many-sided manufacturing cities. Chicago, next to New York, is the largest manufacturing city in America. Minneapolis and St. Paul make not only lumber and furniture, but boots and shoes, woollen goods and many other factory products. Every large city tends rapidly to become a centre of manufactures of many kinds.

Even the finer products of manufacture, such as cotton and woollen goods, china, fine pottery, watches, jewellery,

laces, and other artistic products are beginning to flourish in the Mississippi Valley. One of the largest cotton mills in the United States was recently installed, with all the modern machines and improvements, in Kansas.

Floods, Levees, and Reservoirs

The Mississippi River and its tributary streams in their general relations to the people of the great valley involve certain large problems. One of these concerns the floods of the Lower Mississippi below Cairo.

The causes of these floods and the history of their movement and duration have been carefully studied. One of the great floods occurred in March, 1897. Previously, during the month of February, heavy rains in the Ohio Valley had brought the Ohio, Cumberland, and Tennessee rivers to a flooded condition. During March, heavy downpours occurred in Missouri, Illinois, and the Ohio Valley till the combined floods from the Ohio, the Lower Missouri, and Upper Mississippi raised the river to high-water mark at Cairo, and poured its flood southward. The continuance of the rains and floods kept up a steady rise below Cairo till crevasses were made in the levees and a part of the flood poured out into the valley of the St. Francis River, in Missouri and Arkansas, and later crevasses were made also into the Yazoo basin in Mississippi, flooding a part of that valley and doing much damage.

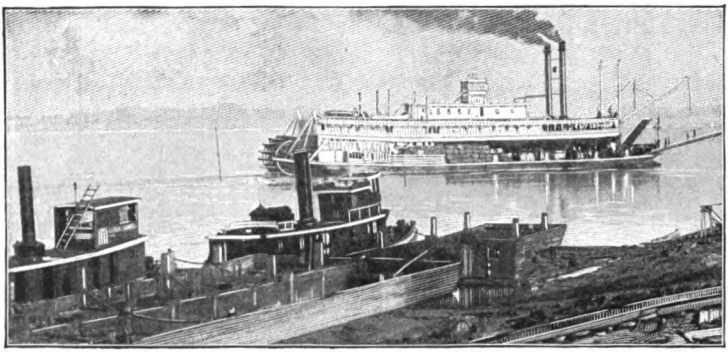
The causes of these floods have been found largely in the cyclonic storms which move from the Gulf of Mexico and southwestern Texas northeastward and bring with them heavy and continuous rains. These storms some-

times move northeastward across the Tennessee and Ohio valleys in February and March, producing freshets; sometimes later in the season they take a more westerly course across the Ozarks and Illinois. The floods from the Ohio usually come in February and March, while those from Missouri and Upper Mississippi in May and June. Fortunately they do not often combine high waters at the same time, or the floods would be far more destructive.

It has been supposed by many that these floods are due to melting snows in the upper courses of the great rivers. While freshets are thus produced in the Upper Missouri and Mississippi, especially when the snows go off with a heavy rain, such freshets, usually, do not produce serious floods below Cairo. The spring floods due to melting snows and rains in the Rocky Mountains produce little or no effect upon the lower half of the Missouri. The Ohio with its branches is the chief cause of the Mississippi floods, since it has a far heavier rainfall and sends a much larger quantity of water into the river below Cairo than either the Missouri or the Upper Mississippi. To the Lower Mississippi River the Ohio contributes about thirty-one per cent, the Upper Mississippi nineteen per cent, and the Missouri fourteen per cent of its waters, while the rivers entering below Cairo furnish the rest, thirty-four per cent. It is thus seen that in quantity of water the Missouri is the least important of the three great head waters of the system. But of solid matter or silt carried into the Mississippi the Missouri furnishes about two-thirds. It carries down from the plains a large quantity of yellow clay or loess material. This contribution of silt by the Missouri is important because it is the excess of this sediment which

tends to fill up the channels of the Lower Mississippi and to build up shallows and deltas.

The problem how to prevent the floods on the Lower Mississippi or to avoid their disastrous effects has been much studied and discussed by engineers. The system of levees, before 1880 supported by the separate states, and since then chiefly by appropriations and a corps of engineers of the national government, has been the chief means



A view across the broad Mississippi at New Orleans. The other bank is seen dimly in the distance. A loaded river boat is just coming in, and others are tied up to the levee.

of protection against floods. Up to 1897 the government had spent about $15,000,000 in protecting and rebuilding levees. They are embankments of earth thrown up along both shores of the river, and designed to be high enough to prevent the waters in flood periods from overflowing the banks and spreading to the cultivated lowlands of the flood plain.

The flood plain of the Mississippi is on the average about

thirty-five miles wide between the uplands or banks of the wider valley. This flood plain is very fertile, as in the Yazoo basin and on the west side both above and below the Yazoo. In some places the flood plain is seventy-five or eighty miles wide. It is for the protection of the farms and crops in these lowlands that the levees are built. The Mississippi engineers who have had most experience in building levees and in trying to control the river in flood times, believe it possible to build the levees sufficiently high and strong to confine the floods within the main channel. By doing this, also, the current is rendered strong and swift so that it not only carries the silt down the river to the mouth, but even scours out a deeper channel for itself throughout its course. If this theory is correct, a complete system of adequate levees will put an end to the damage by floods and at the same time will prevent the silting of the river bed and make a constant elevation of the levees unnecessary.

For many years the low bottom lands of the St. Francis River, about eight thousand square miles, were not protected by levee embankments, and in time of floods the excess of waters escaped into this bottom land, and spreading out, not only lowered the water in the river, but delayed greatly the progress of the flood southward. Some twelve or fifteen days later these waters of the St. Francis basin were collected at the mouth of the St. Francis River and again poured out into the Mississippi River. If this addition happened to meet a flood from the Arkansas and White rivers, it produced an immense flood in the Mississippi below the mouth of the Arkansas. In recent years a levee has been built along the western bank of the

Mississippi to protect the St. Francis Valley. The result has been that the levees had to be built several feet higher along the Lower Mississippi to protect the lowlands from the great floods that come down from the Ohio and Upper Mississippi.

It has been proposed to diminish the Mississippi floods by building large reservoirs at the head waters of the Upper Mississippi, Ohio, and Missouri. By the building of dams across the valleys in these upper streams, extensive lakes and reservoirs can be established which will hold back the water from melting snows and spring rains, and allow it to escape later in times of low water or drouth. Such reservoirs if established in sufficient size and number would probably have some effect in diminishing the excess of floods, but so far as investigations have been made, the Upper Ohio Valley from which the floods chiefly come seems to have very few favorable sites for reservoirs, and their construction even in a limited number would cost many millions. Again, the floods of the Mississippi do not spring generally from the sources of the great rivers, but chiefly from heavy and long-continued rainfalls in the middle and lower courses of the Ohio, Missouri, and Upper Mississippi. For example, the smaller rivers which flow into the Missouri and Mississippi from the Ozark Mountains contribute a large reënforcement to the great floods, as this region is one of very heavy rainfalls.

For other good reasons, however, the building of extensive reservoirs near the sources of the great rivers may prove of much value to the people of the Mississippi Valley. Nearly all the streams coming down from the Rocky Mountains are used for irrigation, and the building

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of extensive dams and reservoirs in the mountains for the purpose of collecting the surplus waters produced by the melting snows and rains of the spring season has already greatly increased the area of cultivation by means of irrigating ditches.

In the lake region about the sources of the Upper Mississippi are very favorable conditions for the construction of reservoirs.

"The largest artificial reservoir system ever yet constructed is that at the head waters of the Mississippi River. The country about the sources of the Mississippi, where the reservoirs are constructed, is about 1200 feet above sea level. It is dotted with an immense number of lakes, the total number having been estimated as high as a thousand. Some of the larger of these lakes afford exceptionally favorable opportunities for the inexpensive storage of water. The dams required are low structures, but the area over which the water is raised by them is so extensive that the cost per unit of volume stored is probably the smallest ever yet realized. . . . Up to the present date there have been constructed five reservoirs each with an aggregate capacity of 93,400,000,000 cubic feet, at a total cost of $678,300. The average annual storage of these reservoirs is estimated at about 40,000,000,000 cubic feet. The original investigations, embracing the states of Minnesota and Wisconsin, indicated a practical storage in Minnesota of 95,000,000,000 cubic feet, and in Wisconsin of 79,000,000,000 cubic feet. . . . There is probably little doubt that the system could be extended so as to secure a storage of 150,000,000,000 cubic feet in the two states." ("The Improvement of Rivers," Thomas and Watt.)

The purpose of these reservoirs is not primarily to prevent floods, but to store up the waters of spring floods, and let them out later in the season of low water so as to deepen the water and improve navigation in the period of summer drought. The effect of the reservoirs already constructed is to raise the water level at St. Paul from one to two feet during a period of ninety days in summer. Such reservoirs have other advantages; for example, in giving a more abundant and steady water supply to falls and serviceable water powers lower down the river, as at Minneapolis.

It is quite possible that even in the Upper Ohio and its branches, reservoirs may be built which will improve the navigation of those streams during the summer season of drought and also supply valuable water powers.

In the end these combined efforts to store up the head waters of streams may have some effect toward diminishing the excess of waters in the great floods of the Lower Mississippi. The preservation of the forests in the mountain regions and about the head waters of great rivers has generally been regarded as a means of diminishing floods, by collecting and holding the water in the soil and among the leaves and roots of the trees, and then passing it off gradually to the streams below. In some cases, especially after periods of drought, the forests may serve this purpose; but it has been denied by some experienced investigators that the removal of the forests has had any great influence upon the size of the floods.

River Navigation

The improvement of the navigation of the Mississippi and its tributaries has been undertaken by the national

government in a variety of important ways. The natural navigation of the main trunk of the river and of its larger branches, as well as of many smaller streams, such as the Illinois and Monongahela, is obstructed in many ways. At the delta mouth of the Mississippi River was the greatest of all obstructions, — a broad, flat bar produced by the river depositing its sediment as its waters lost their current and spread out on the edge of the Gulf. Across these various bars there was a depth of only six to ten feet of water, which did not allow even smaller vessels to pass easily, to say nothing of ocean-going ships. For many years dredges were used in the southwest pass to scoop out the sand and mud and open up a passage for ships. The problem was finally solved by Captain Eads, who, under government support, constructed jetties through the south pass and obtained a constant depth of thirty feet across the bar.

In many parts of the Mississippi and its tributaries the channel is obstructed by snags and shallow sand-bars, especially in times of low water. The government employs regular squads of engineers and workmen whose business it is to clear away these obstructions, removing the snags with boats rigged up for this purpose, and employing dredge boats for lowering the sand bars and deepening the channels where needed. In some places where there are rapids and consequent shallows, the river has been narrowed by building out projecting jetties of heavy material, wood and stone, so as to narrow the channel and deepen the current or cause it to scour out a deeper passage.

At Louisville are falls in the Ohio, where the waters

descend about twenty feet over a series of limestone ledges. A canal some two or three miles long has been built to allow boats to pass round these falls. At Keokuk, Iowa, also, is a canal in the Mississippi for avoiding the rapids.

One illustration of the government work in improving the navigation of smaller rivers is the series of dams and locks in the Monongahela River by which the water in that river is made navigable many miles into West Virginia. The navigation of the Monongahela is of unusual importance on account of the immense tonnage of coal shipped in barges down this stream to Pittsburg and the Lower Ohio. The government has spent several millions of dollars in building the dams and locks by which the Monongahela waters are collected into a series of pools which are navigable for steamboats and heavily laden barges.

The Illinois River is supplied with a similar system of slack water navigation by which it is connected with the Illinois and Michigan Canal and Chicago. The great drainage canal connecting the Illinois with Lake Michigan is expected to be eventually a part of a deep water canal connecting Lake Michigan with the Mississippi through Illinois.

The navigation of the Alleghany, the Cumberland, and Tennessee, and other smaller rivers has been improved in a similar manner.

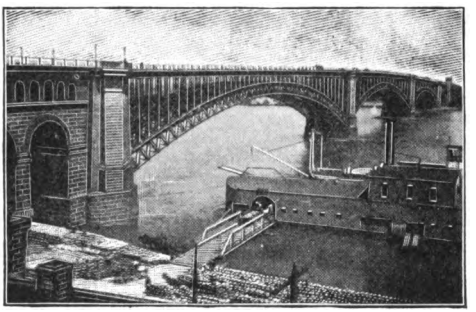
It has been often said in recent years that the railroads have monopolized commerce, and that river navigation has dwindled into small dimensions. It is claimed, however, by steamboat men, that the rivers still transport a large quantity of goods. The passenger traffic, with splendidly equipped steamboats, is not what it once was, but the local traffic is large, and the barge freight is extensive. "Steam-

boats to the number of 189 ran on the river in a recent year with a gross tonnage of 1,950,004 tons. These boats made 6212 trips. The value of the boats was $4,331,000. There were 1635 barges, towed by steamers. These barges made 2470 trips. The value of the barges was $2,003,000. This made a total of 1824 vessels in a year. Their net tonnage amounted to 1,471,128 tons, while their value reached $6,334,000. The harbor boats, the ferries, the railroad transfer boats, and the government steamers are excluded from this recapitulation. The total amount of tons from Cairo to New Orleans was 4,708,355, with a valuation of $94,605,762. From New Orleans to the Gulf, via the river, the coastwise and foreign tonnage was 2,985,643 tons, valued at $144,704,136. This makes the grand total of 7,693,998 tons, with a valuation of $239,309,898. Chief among the merchandise carried on the river that year were 612 bales of cotton, 166,049 tons of cotton seed, 153,664 tons of sugar, and 444,539,180 feet of logs and lumber. The cost of a river steamer ranges from $20,000 up to $100,000." ("Workers of the Nation," Vol. II, p. 577.)

Bridges interfere considerably with the navigation of rivers, although the government has tried to impose conditions upon bridge building that would leave the navigation unimpeded.

The building of canals connecting the upper waters of the Mississippi with the Great Lakes, and the Ohio with the Lakes, was formerly regarded as a matter of great importance, so that such connecting canals were built in Wisconsin, Illinois, Indiana, Ohio, and Pennsylvania. Some of them have fallen into disuse, but schemes are still

on foot to connect Chicago by an enlarged canal with the Mississippi, and Pittsburg with Lake Erie, and the time may come when such large canals will play a most important part in the traffic of the United States.



Bridge at St. Louis.

Historical Importance of the Mississippi River

During the period of discovery and exploration the Mississippi and its tributaries furnished the easy routes for adventurous exploring parties. In the South the Spaniard, De Soto, first came in sight of the great river, and in the North the French traders and priests, Marquette and Joliet, Hennepin and La Salle, crossed from the Great Lakes to the Wisconsin and Illinois, and later explored the Mississippi to the Delta. Most of the early settlements, as at Detroit, Mackinac, St. Louis, Kaskaskia, and New Orleans, were made by the French, and these French and Indian names still remind us of this early history.

The Ohio Valley was possessed during the Revolution and immediately after by the hardy pioneers led by Robert-

son, Boone, and Sevier to the south, and by George Rogers Clarke, General Putnam, and Anthony Wayne north of the Ohio.

After the purchase of Louisiana in 1803 began the definite exploration of the Missouri Valley, first under Lewis and Clarke and later by Frémont, Pike, Kit Carson, and others.

Throughout the whole Mississippi Valley this period of exploration is one of remarkable interest to young people. It involves a lively description of striking scenery and adventurous exploits of men rightly famous in American history.

The period of pioneer settlements follows closely upon the heels of the explorers and is made vivid and lifelike in the early lives of Robertson, Andrew Jackson, Davy Crockett, and Abraham Lincoln. The steamboat period on American rivers, before railroads began to compete with river craft, is one of the most important and interesting sides of Western life up to the time of the Civil War. During the Civil War itself, the Cumberland, Tennessee, and Mississippi rivers offered the chief lines of approach to northern generals in their efforts to master the southern armies. Vicksburg and Chattanooga were the pivotal centres of these movements. The Mississippi Valley furnished the presidents, many of the leading generals, and a large part of the troops on both sides of this great civil conflict.

Among literary works much used in the schools Longfellow's "Hiawatha" is closely associated with the Upper Mississippi, and "Evangeline" with the Lower Mississippi.

Since the close of the Civil War the growth of popula-

tion and the increase of wealth in the broad valley have been rapid and surprising, so that now about half the people of our country dwell in this region. It has become the home also of many races.

Of the original Indian peoples, most of the remaining tribes are collected in large Indian reservations, as in Indian Territory, in Minnesota, the Dakotas, and other states.

In Louisiana the original French settlers still constitute a considerable portion of the population, and many of the names of rivers, cities, parishes, and families are constant reminders of early French history in the South.

Throughout the cotton-growing districts of the lower valley the negroes are numerous and perform the heavy work of agriculture, lumbering, and the simple trades. By nature and long heredity they are better adapted to endure hard work during the hot summers than white men.

In Minnesota and the Northwest the Scandinavian races abound and give character to that region. There are many townships in Minnesota where the English language is scarcely spoken, and even in the cities the language heard from the pulpit is often Swedish, Norwegian, or Canadian French.

In the great cities like Cincinnati, Milwaukee, Chicago, and others, the Germans prevail, and constitute sometimes a half or more of the population. The Italians, Jews, Hungarians, and Russians have also helped to people the Mississippi Valley, so that it has become more or less a home of all races.

The cities of the Mississippi Valley, although of recent growth, are among the largest and wealthiest in the United States. The largest, Chicago, lies on Lake Michigan, on

the narrow watershed between the lake and the Mississippi, and actually stretches westward across the Des Plaines River which drains into the Illinois, and now by means of the Drainage Canal carries the sewage of Chicago into the Illinois River. All the chief cities—New Orleans, St. Louis, Cincinnati, Pittsburg, St. Paul and Minneapolis, Kansas City and Omaha — are largely dependent for their location upon the advantages afforded by rivers. The river advantages have determined the location of every important city in the Mississippi Valley. The only possible exceptions to this rule that may be cited are Indianapolis and Denver, smaller cities, which, however, are located on considerable streams of the Mississippi system. Pittsburg, at the head of the Ohio, and the Twin Cities, at the head of the Mississippi, are natural and inevitable locations for cities, while St. Louis and New Orleans are scarcely less so.

The location of these cities in the narrower valleys of rivers not only brings them close to river traffic, but furnishes equally well the natural route and meeting place of railroads. Without regard to river traffic, Pittsburg is the only natural centre for the railroads of western Pennsylvania. River valleys almost everywhere are the preferred routes of railways, especially in the more hilly or mountainous regions.

Comparisons

In comparing the entire basin drained by the Ohio and its tributaries with the drainage area of the Missouri, we notice that the Missouri (3000 miles) is more than three times the length of the Ohio (975 miles). The area of the entire Missouri basin (527,155 square miles) is more than

two and one half times that of the Ohio (including the Tennessee and Cumberland rivers, 201,720 square miles).

On the other hand, the Ohio River pours more than twice as much water into the Mississippi River as the Missouri. This implies a great contrast in the climate of the two regions. The rainfall throughout the Ohio Valley is heavy, while the greater part of the Missouri is arid. Originally almost the whole Ohio Valley was heavily forested and much is still so, while the greater part of the Missouri basin is a treeless plain, partly prairies, but mainly arid plains with only a scanty grass covering. To the traveller these two regions are strikingly opposite in appearance. The climate of the western Missouri plains is dry and windy, with prevailing sunshine. In the Ohio regions much of the weather is damp and cloudy, with frequent heavy rains. Everywhere in the Ohio Valley rich farm lands have displaced many of the forests, while great stretches of the western plains are almost deserts, and with their scanty grass are good only for cattle ranches. At the eastern foot of the Rocky Mountains narrow strips of irrigated lands along the rivers are contrasted with the prevailing drought and barrenness of the surrounding country.

The Missouri has its sources high among the snows and barren ridges of the Rockies (14,000 feet in height). Only a few of the sources of the Ohio are more than 3000 feet above sea level. As the rivers reach the plains at the foot of the Rocky Mountains, they are from 5000 to 6000 feet above sea level. At Pittsburg the Ohio is about 600 feet above sea level. The current of the Ohio is therefore less rapid and more easily navigable than the strong, swiftly descending current of the Missouri.

A study of the population and cities of the two valleys will show that the Missouri Valley has but three cities of more than 100,000 each, while the Ohio Valley has seven. In the neighborhood of Pittsburg there are more than 700,000 people, a larger population than in all the large cities of the Missouri Valley. Moreover, the population, agriculture and manufacturing industries of the Ohio are far in excess of those in the Missouri basin.

A comparison of the Upper Mississippi with the Lower Mississippi reveals also some interesting contrasts. The Upper Mississippi has a long, narrow flood plain, between high bluffs, the Lower Mississippi has a broad alluvial flood plain, spreading out many miles toward low bordering hills. In Louisiana a semitropical climate favors orange groves, winter roses, and sugar cane, while Minnesota is famed for deep snows and winter logging camps, ice palaces, and zero weather.

The Upper Mississippi is a lake-sprinkled plateau abounding in woods, game, and fish. Southern Louisiana is a wilderness of low swamps, bayous, and delta lands. The population of the South comes largely from France, Italy, and Africa, and of English stock also, while the North abounds in Scandinavians, Germans, English, and Yankees. In the North were extensive forests of white pine, in the South still larger regions were covered with yellow pine, which has of late taken the place of white pine in the markets. The northern regions lie close to the Great Lakes, and find through them an outlet for their products eastward to the Atlantic; the south lies near the warm Gulf, and pours its commerce via New Orleans and the Gulf of Mexico into the Atlantic Ocean.

Such comparisons bring out more clearly the wide extent of the Mississippi Valley and its variety of climate, products, people, and scenery.

Before completing the geography of North America, the Mississippi as a whole should be compared with other large river systems of this continent. The St. Lawrence is next in importance to the Mississippi, although its drainage area is but little more than a third of the Mississippi basin.

Although these two systems are so close together, they are radically different in three very important respects. The St. Lawrence is the outlet for the greatest system of fresh-water lakes in the world. The Mississippi has no large lakes at all (the small lakes at its source having no comparison with the Great Lakes). In fact, the St. Lawrence almost loses the character of a river and exhibits only a series of short channels serving as outlets to lakes. The course of the St. Lawrence is obstructed by large falls and rapids at three important points in its main course,—the Soo Falls, Niagara, and the Rapids above Montreal, each requiring costly locks and canals. The Mississippi and its large branches have no important falls in their main courses, although at Louisville and Minneapolis the river has a suggestion of similar features.

The Mississippi carries southward a heavy load of silt which it spreads out along its lower course and with which it has built up a vast delta. The St. Lawrence carries almost no silt and has no delta, but instead a large tidal estuary, opening to the ocean.

Whatever silt is gathered along the St. Lawrence is deposited in the Great Lakes, and the waters of Niagara

and the Lower St. Lawrence are almost pure and free from sediment. For a similar reason the St. Lawrence has no floods, but an almost uniform flow of water throughout the year; while the Mississippi and its tributaries are swept by enormous floods, carrying damage to many parts of the valley. The Great Lakes are natural catchment basins where the flood waters of tributary streams are gathered up and passed out gradually.

Both these rivers are of vast importance to commerce, the St. Lawrence and lakes perhaps even more so than the Mississippi. The ports on the Great Lakes are very numerous, large and important, and during the season of navigation the railroads cannot compete successfully with the cheap freight rates of the lake steamers.

A comparison of the leading lake ports with the river ports of the Mississippi Valley as to size and importance suggests an interesting study for children.

The Lower Mississippi has the advantage of being open to navigation throughout the year, while the lakes and the St. Lawrence are closed during the winter months. The St. Lawrence has the peculiarity of being the boundary line between two nations throughout most of its course, and its advantages for navigation and water power must be shared by these friendly peoples.

The Colorado River, one of the most remarkable rivers in the world, is wholly different both from the Mississippi and the St. Lawrence. Unlike either of these rivers, it drains a mountain and desert region devoid of population, with almost no cities or industries, and supplying no navigable waters in its main course. Its monster cañon, hundreds of miles in length, can find nothing similar in the

whole Mississippi and St. Lawrence basins, except a few cañons in the mountainous regions of the Upper Missouri and Arkansas, and the Saguenay of the Lower St. Lawrence.

The Mackenzie River of the Arctic plain, like the St. Lawrence, drains a group of large lakes, but its lower course is obstructed with ice, so that it is of little importance to man.

From this brief comparison it is clear that North America exhibits a striking variety of great rivers.

In the later study of important rivers in Europe, Africa, Asia, and South America many interesting points of resemblance and of striking contrast will appear, and it will greatly stimulate both the memory and the reasoning powers of children to make these comparisons and draw the inferences. The Nile, for example, resembles the Mississippi in its delta and flood, the St. Lawrence in its system of great lakes, and the Colorado in the fact that it flows hundreds of miles through a desert and rainless region.

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THE IRON AND STEEL BUSINESS

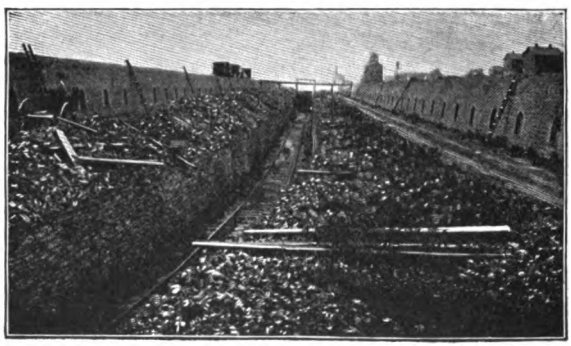
PITTSBURG, in western Pennsylvania, is the chief iron and steel producing centre of the United States. In all the neighboring cities and towns of Pittsburg, scattered up and down the valleys of the rivers, are the glowing furnaces and smoking chimneys of the huge steel mills.

In order to understand better the work of one of these great steel mills and its processes of iron and steel production, we will describe the Cambria Steel Works at Johnstown, Pennsylvania. They are somewhat isolated from the great plants at Pittsburg and can be grasped as a distinct unit of study.

The Cambria Steel Company of Johnstown, Pennsylvania, is one of the chief iron and steel producing plants of western Pennsylvania. It has a large number of blast furnaces and mills located just above and below the bridge, where occurred the great flood disaster of Johnstown in 1889. This company employs at Johnstown in its mills and mines about thirteen thousand men. This includes nearly the entire working population of Johnstown and its suburbs, in all about fifty thousand people, excepting, of course, the necessary grocers and trades people found in any town. The Cambria is an old company, or the outgrowth of an old company, which has long manufactured iron and steel products at Johnstown.

Originally the iron ore and coal used were mined from the hills about the town, and the limestone was brought

from a few miles away. At the present time the Cambria Steel Company owns large iron mines in the Mesaba district of Minnesota, where it employs some four hundred men to load and ship the ore. The iron ore in these mines lies so near the surface that, after stripping off the top cover of dirt and rock, the ore can be scooped up by great steam shovels into the cars. A train load of these cars is run into this open, quarrylike pit, loaded in a few minutes,

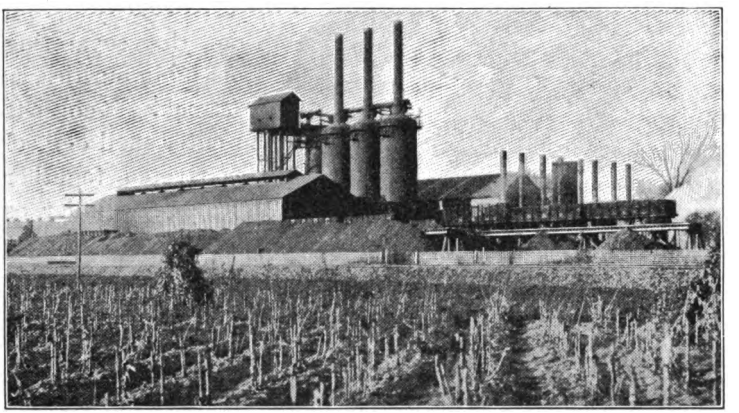


Coke Ovens.

and hauled down to the great ore docks at Duluth, where the car loads are dumped into chutes which carry the ore from the high docks down into the holds of vessels. The ore docks at Duluth and at other Lake Superior ports illustrate well the labor-saving machines and devices for handling swiftly and cheaply a vast quantity of heavy ore. Lake vessels, sometimes carrying 7000 tons each, bear this ore to Erie, Pennsylvania, where it is reshipped by rail to Johnstown.

It takes vast quantities of coal (coke) to supply the

blast furnaces and mills at Johnstown. A large part of this coal is obtained from three or four extensive mines owned and operated by the company at Johnstown. The company employs constantly near one thousand men in its own coal mines, and the coal is obtained from tunnels running back into the steep bluffs (600 feet high) on both sides of the town, and is carried out and delivered by trolleys and tracks directly to the mills.

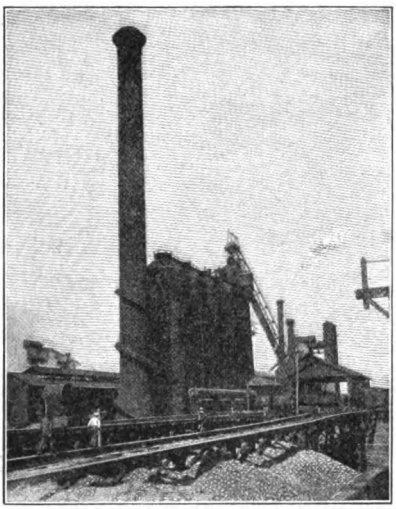


Blast Furnace and Ovens.

In the Connellsville coal region of southwestern Pennsylvania the Cambria Steel Company receives the product of large mines, employing six hundred men. The Connellsville coal is famous for coking, and train loads of this coke are brought for use at Johnstown.

The limestone which is needed in large quantities in the blast furnaces is brought in train loads from limestone quarries east of Johnstown.

In the production of iron and steel at Johnstown, there are three principal processes which deserve special attention: first the blast furnace for producing pig iron; second the Bessemer converter, or the open-hearth furnace for making steel; and third the rolling mills for shaping steel bars, plates, billets, etc.



Blast Furnace.

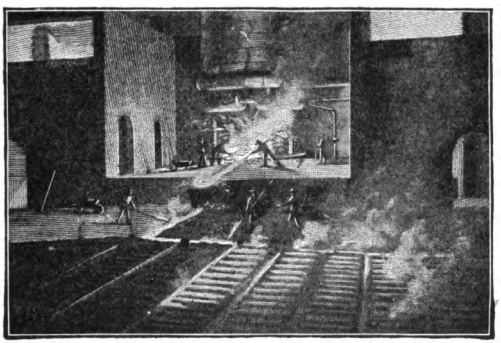
The blast furnace is a chimneylike or towerlike furnace for smelting iron ore and thus separating it from its impurities, as slag or rock. It consists of an outer shell of steel plates riveted together like a huge cylinder or upright boiler about eighty feet tall, and this is lined with a fire brick wall three feet thick.

From below the centre it tapers toward the top and bottom. Near the bottom are tuyeres or openings through which the hot blast enters, and a kettle-like basin in which the molten iron collects.

The interior of this furnace contains the iron ore and other ingredients.

The blast furnace is filled or charged from the top, and an elevator or sloping track is built by which a car loaded with fuel, limestone, or ore can be carried to the top and its contents dumped into the furnace.

When the furnace is ready for the charge, first a layer of fuel and coke is carried up the slope and dropped in, on top of this a load of ore and then a layer of limestone, these three being the principal materials in the charge. By repeating these successive layers the furnace is filled to the top. The fire is started at the bottom, and to increase



Molten Iron running from the Blast Furnaces.

the heat a blast of hot air is forced into the burning mass from near the bottom of the furnace. This hot blast raises the burning mass to an intense heat (from 1800 to 2000 degrees Fahrenheit in the lower third of the furnace). This reduces the mass of ore and lime to a liquid, the lime and cinder combining with the impurities in the iron ore to form a light slag, and the carbonic acid of the limestone combining with the iron to form pig iron. The iron being much heavier than the other materials settles to the bottom, and the lighter materials floating on top are drawn off from time to time through an opening.

Once in three or four hours the melted iron collected at the bottom is drawn off through a round hole that was plugged up by a ball of clay, but is removed to allow the flow.

Formerly the top of the blast furnace was left open and the escaping gases burned with a brilliant light. In recent years the top is kept closed by a double cup-and-cone arrangement, like a double valve, by means of which the charges can be dropped into the furnace without allowing the gases to escape. In a modern blast furnace one can see two large pipes which tap the sides of the furnace near the top and carry off these gases to be used in the ovens for heating the hot air blast. By saving and using these gases the cost of fuel for the blast furnace has been reduced about thirty per cent, and great economy secured.

Close beside the blast furnace stand four cylindrical towers, about twenty feet in diameter and as tall as the furnace. They are called ovens, because in them the air is heated before being forced into the blast furnace.

At each drawing off about eighty or one hundred tons of molten metal are obtained, and as this occurs about seven times each day of twenty-four hours, a blast furnace may produce daily from five hundred to seven hundred tons of pig iron.

Oftentimes the molten metal is received into ladles or large cups holding seventeen tons each and from them poured into a great, boxlike receptacle called the mixer, from which it is then poured out into other ladles and carried to the Bessemer converter, where it is at once changed into steel. There is much economy in putting

the melted pig iron at once through the Bessemer process without allowing it to cool. For when once cooled the expense of reducing it a second time to a molten state is considerable.

The blast furnace when once put in operation is kept at work day and night until it is worn out. A good furnace lasts a year and a half or two years.

Frequently, however, in drawing off the molten pig iron from a blast furnace it is allowed to flow down along a large trough of sand and from this, laterally, to smaller troughs where it is allowed to cool in the form of bars, called pigs. We often see these bars of pig iron stacked up in the yards or loaded upon cars. They are much used in foundries all over the country, in making castings for stoves, machinery, etc.

The Cambria Steel Company has several large blast furnaces in constant operation, which produce about two thousand tons of pig iron daily. Estimate the amount per month and per year.

The second important step in the industry is that of making pig iron into steel.

The Bessemer converter is one means by which this is done. "The converter is a barrel-shaped wrought-iron vessel, lined with refractory materials and carried on trunnions, one of which serves to conduct the air blast to the bottom of the converter, which contains twenty air tuyeres, each of which is perforated with a number of half-inch holes." (*Scientific American*, December, 1903.) The converter swings easily on its trunnions, and is turned into a horizontal position to receive the charge of molten pig iron (fifteen tons) from the ladle. Then it is turned

to an upright position and at the same instant the blast of air is forced up through the numerous holes in the bottom; and as this air strikes the molten mass it sets up a roaring combustion. The oxygen in the air combines with the carbon and other impurities of the pig iron, and the already intense heat (1800 degrees) is quickly raised to 3200 degrees or more. The converter gives forth a roaring noise and a most brilliant light, and in eight or ten minutes all the impurities are burned out of the iron and it remains pure. In fact it is too pure, and, as it is poured out, some spiegeleisen is shovelled into it to supply a small amount of carbon and manganese needed to make the desired quality of steel.

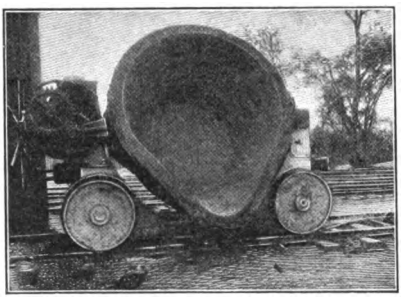
A second method of producing steel from pig iron is known as the "open-hearth furnace." The Cambria Steel Company has several such furnaces.

An open-hearth furnace is a brick structure about fifty feet long and fifteen feet wide, with several doors opening at the side upon a platform from which the charging machine works. "The open-hearth furnace is a large dish-like structure lined with refractory brick and sand into which the mixture (of pig iron, etc.) is loaded by powerful Wellman-Seaver electric charging machines that run on tracks laid upon the charging platform in front of the furnaces." (*Scientific American*, December, 1903.)

This charging machine, worked by one man, is an application of electrical force. It drags a chain of small cars to the front of the furnace, loaded with long boxes of iron. It lifts one of these boxes with fifteen tons of iron, thrusts it into the door of the furnace, turns it upside down, and thus in fifteen minutes charges the furnace with fifty tons

of iron. This machine, under the direction of one man sitting in a chair, does the work of fifty men.

When the furnace has been charged, the doors are closed and a current of hot burning gases is turned on from one end of the furnace and the iron is soon heated to a liquid form. It requires from eight to twelve hours of firing to burn out the impurities and to bring the charge to a fine quality of steel. We noticed that the Bessemer converter required only eight or ten minutes. But the quality of steel produced in the open-hearth process is much superior to that resulting from the Bessemer process. In the open-hearth furnace the steel-making process can be very accurately regulated, careful tests are made from time to time, and steel of a given quality and strength produced. For example gun-metal and armor plate can be made by the open-hearth, but not by the Bessemer process.



Interior View of Ladle.

When the heated metal is ready to be drawn off, a large ladle, swung into position by a gigantic electric crane, is lowered on the back side of the furnace, so that from a side opening from the bottom of the furnace the molten metal can pour out into this ladle. This huge cup receives the whole charge, fifty tons of boiling, sputtering metal; and as one looks into the cup, there is such a brilliant light that it completely dazzles the eyes, and one can

see the contents of the cup only through a darkened glass.

The Cambria Steel Company has fifteen of these open-hearth furnaces and turns out at present a thousand tons of steel per day. They are now building large blast furnaces near the open-hearth furnaces so as to supply them directly with molten pig iron. By this saving of time and fuel they expect to produce from 1300 to 1500 tons of steel daily. By means of the Bessemer converters which produce 2000 tons of steel daily and the open-hearth furnaces with 1000 tons daily, the total output of the Cambria Steel Company is now 3000 tons daily, or more than a million tons a year.

In both cases (converters and open-hearth furnaces) the molten steel is carried by the great ladles and poured into ingot moulds which stand upright upon cars ready to receive the metal. An *ingot mould* is a hollow, slablike structure about eight feet tall, flat on the bottom so that it can be set upright on a flat car, and with a rectangular hollow extending through its length. The molten metal is poured into this hollow centre and the sides of the mould soon cool and harden the column of hot steel. An ingot mould will receive from seven thousand to twenty-five thousand pounds of molten metal. The fifty-ton ladle may, therefore fill up six or seven of these moulds as they stand waiting.

When the column of metal in each of these moulds has cooled sufficiently, an engine drags the cars under a stripper, a powerful machine, which reaches down a pair of great iron claws and laying the iron teeth into the sides of the mould, strips off the mould, leaving the column of red-hot

steel standing on the car. The ingot mould is slightly wedge-shaped with the small end at the top, and in addition to this an iron piston is pushed down from above to loosen the iron from the mould. The iron, in cooling, also shrinks away somewhat from the mould so as to aid the stripping.

Before being carried to the rolling mills these columns of red-hot iron are lifted one by one by an overhead electric machine, and lowered into a soaking pit, where they are "soaked" in a flame of burning gases until they are of uniform temperature throughout the mass. When first stripped the outer crust is hard and the interior still molten, so that if put under the rollers the columns would go to pieces or collapse.

The third great process is that of the rolling mills, where these red-hot, soft steel slabs are passed under the rollers and shaped into various forms, as steel rails, broad steel plates, steel billets, and armor plate.

"From the soaking pit the ingot is taken to the blooming mill and is given seven passes through the blooming rolls, by which it is reduced to a section nine and one-fourth inches square and fifteen feet in length. Then it is sheared into two or three lengths according to the length of the rail which is to be rolled. The blooms, as they are called, are now reheated in the bloom furnace and carried direct to the great rail mill, consisting successively of roughing rolls, intermediate rolls, and finishing rolls (or rollers), which extend one after the other down the full length of a building that is nine hundred feet in length." The above is the process of making steel rails, but a similar series of rollers is used to turn out steel plates (*e.g.* boiler plate) and various thicknesses of armor plate.

The Cambria steel mills produce steel rails, steel plate, all kinds of steel billets, and armor plate not more than three or four inches thick, used in constructing protected cruisers.

There is one department of the Cambria Company, known as the Gautier department, that works up these materials into the finished products. The most important finished product which they turn out is the steel cars used for hauling coke, coal, iron ore, and other heavy material.

The Gautier department also works up great quantities of structural steel for building bridges and the frames of large city buildings, such parts as beams, braces, angles, channels, etc. The Cambria Company takes contracts for the construction of bridges and houses, and has a force of contractors and draughtsmen for working out such plans and specifications, for which the mills undertake to supply the exact materials.

The Gautier department supplies shaftings for mills and factories, also the iron or steel parts of agricultural implements, as wagon tires, springs, axles, ploughshares, harrows, car axles, castings for all sorts of engines and machines, and many sizes and forms of steel bars and rods which are used in mills and shops all over the country in making special forms of machinery.

In all, the Cambria Steel Company manufactures daily about three thousand tons of iron and steel products. We have already described the sources from which it derives the raw materials for this manufacture and the processes involved. To what places are these goods shipped and sold? For it is from sales that the company must cover its expenses and provide for profits.

The products which this company turns out may be needed in nearly all the steel-working factories and machine shops of the United States. This includes the factories producing agricultural implements, wagons and buggies, steam engines, cars, printing-presses, etc.

Among the larger manufacturing companies to which the Cambria Company may sell its goods the following may be mentioned by way of illustration: The Deering Harvester Works and McCormick Works at Chicago; the Walter A. Wood Mowing and Reaping Machine Company of Hoosack, New York; the Adrian Platt Company, Poughkeepsie, New York; the Richardson Manufacturing Company, Worcester, Massachusetts; the Johnston Harvester Company, Batavia, New York; the Southern Plough Company, Columbia, Georgia; B. F. Avery & Sons, Louisville, Kentucky; the Rhode Island Plough Company, etc. They cultivate especially the eastern market, the Middle Atlantic and New England states. But they sell very extensively in the South (ploughs for cotton fields) and in the West, and some goods are sent even to foreign countries. The eastern market is open to them and they have the advantage of being nearly eighty miles nearer Philadelphia and New York than Pittsburg is. The chief competition, of course, is with the similar factories of the Pittsburg district. But they in turn have a small advantage in freight rates for the western trade over the Cambria Steel Company.

There are several special departments of the works that deserve further mention. First is the repair machine shop under the management of the chief engineer. It consists of a fully equipped iron and steel working shop on a

large scale, and employing two thousand workmen. Its business is to construct new mills and machines as they are needed in the works, and to keep all mills, machines, furnaces, and factories of the Cambria Company in good working order. It is evident that this shop must possess almost every kind of iron and steel working machine, as it will be constantly called upon to do an infinite variety of skilled work in building or fixing engines, electrical apparatus, smelters and furnaces, rolling mill machinery, mining apparatus, etc. The fact that two thousand men, largely skilled workmen, are employed in the repair shops alone, shows how expensive it is to carry on such a great enterprise as the Cambria Steel Works.

Second, the company has at their works complete chemical and physical laboratories, and smaller laboratories in each department for immediate use. These are amply fitted up with apparatus and supplied with skilled specialists in these lines. A great manufacturing company in our time must keep up with the progress made in physics and chemistry, in new inventions and processes, and must apply the results directly to manufacturing. This illustrates how great industries and the highest forms of education go hand in hand. The specialists are university-trained men.

Third, in such extensive works, employing thousands of men, many accidents, dangerous to life and limb, are certain to occur. To meet these needs the company has a fully equipped hospital with an operating surgeon and trained nurses, with first-class operating rooms. In fact it is said to be one of the most complete and well-regulated hospitals in this part of the state. As soon as a person is

injured he is taken to the hospital and treated, and kept there till he is well enough to be taken to his home.

Fourth, a considerable force of well-trained architects and draughtsmen is employed in well-equipped rooms, to work out plans and specifications and drawings for contracts in bridge and steel house construction. The company undertakes such contracts in many parts of the United States.

In addition to this the company has offices in large cities, as in New York, Philadelphia, Boston, and Chicago, in each of which a force of architects and draughtsmen is employed in making plans and figuring on contracts which are sent in to Johnstown to be worked out in the mills.

The Cambria Steel Company has its general offices and management at Philadelphia. The capitalists who furnish the money or own the controlling stock live at Philadelphia, and they as directors must determine the large plans and work of the company.

At Johnstown, however, lives the general manager of the Cambria Company, the man who from his office directs the work in all the mills and mines at Johnstown, and in the mines at Connellsville and in Minnesota. The entire plant, with all its mines, blast furnaces, rolling mills, and shipping interests, is under his general control, and he is chiefly responsible for the success of the business. It requires long experience in all forms of the iron manufacture, and great ability and energy, to conduct such a business with success.

The company has a capitalization of $50,000,000 invested in its mills, mines, and equipment. In the conduct of the business, a reasonable profit above all expenses must be

made upon this immense investment. A six per cent profit, yearly, would amount to how much?

Of course the general superintendent has a large number of assistant superintendents and foremen who are responsible for the special departments. Each mill has its experienced and responsible foreman, who is constantly watchful in supervising the men and machines in his department. Many of these men, as stated above, are highly educated, having been trained in universities and technical schools. Besides the large force of trained chemists and physicists there are many technically educated mining and mechanical engineers. In all the processes of iron and steel production the chemists and physicists are at hand to test the quality and strength of the materials. For example, before being put into the blast furnace every car load of iron ore, of coke, and of lime is examined and tested by the chemist to determine its quality and constituent parts. Likewise the molten metal in the open hearth furnace is often examined during the heat to determine its quality and strength. Again, in the rolling mills the steel rails and plates are tested for tensile strength and toughness. All products of steel manufacture must come up to a given standard of purity and strength, based upon chemical tests for constituent parts, and upon physical tests made by breaking or stretching the steel. Without the superior knowledge of men trained at universities and higher technical schools, such an iron and steel plant could not be carried on at all. They are needed in every mine and mill and department of the work. One of the most important men in the whole plant is the chief engineer, who has general charge of the construction and repair of all buildings, machines, furnaces,

engines, tracks, etc. This company owns, for example, and operates one hundred miles of railroad track within the limits of its own works at Johnstown, with a full equipment of engines and cars. It has a great many powerful electrical machines, cranes, and derricks, immense hydraulic presses, and great coke and gas producing works for supplying its furnaces and mills. There are, of course, many expert machinists, electricians, and engineers who have charge of these departments and machines, and according to their skill and experience they receive good wages.

There are also thousands of men employed in doing the heavy work of lifting, loading, shovelling, and in many other ways handling the heavy materials which pass through a rolling mill. These common laborers, who possess no kind of skill but only muscular strength, receive the lowest wages, $1.20 per day.

In the coal mines at Johnstown are found many Welsh, Hungarians, and other foreigners, who, perhaps, in their old home in Europe were mining operatives.

Just above the steel works at Johnstown, on the hill slopes, are many houses owned by the company, which are let out to the workmen with families, especially to those who have been long and steady employees. The thirteen thousand men, however, live in all parts of the city and constitute, with their families, the bulk of the population.

The Cambria Steel Company not only furnishes employment to thirteen thousand men at Johnstown, but also pays large taxes for the support of the public schools of the city. The city library, located near the chief works, is supported entirely by the company and in its adjacent rooms lectures

are given on technical subjects such as electricity, chemistry, mining, and engineering, which the operatives in the mills may wish to study.

Most of the tradespeople and storekeepers throughout the city are engaged in supplying those necessities which the employees of the mills and their families require. So long as the great mills are in full operation all kinds of business prosper. Merely in wages the Cambria Company pays out from twenty to twenty-five thousand dollars a day. What would this amount to in a month? A year?

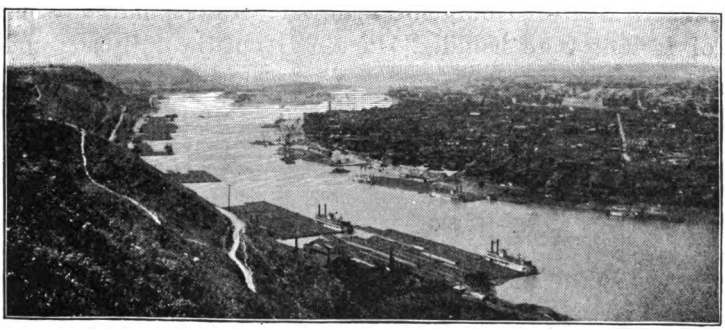
This company has never been disturbed seriously by strikes. Its workmen have not formed unions, the reason being that the whole plant is removed from the big centres like Pittsburg and Chicago, and the treatment of the workmen by the company has been liberal and satisfactory.

The Cambria Steel Company does the large part of its shipping over the lines of the Pennsylvania system of railroads. This amounts to several millions of tons yearly. In fact, it constitutes an important part of the traffic of this system in Pennsylvania and beyond.

In order to understand the business of such a large company we must make a careful study, first of its iron and coal mines and lime quarries as its sources of raw materials, also its means of transportation; second, the great plant at Johnstown with its variety of mills and processes; third, its means of distribution of manufactured products to all parts of the country and of the world; and fourth, the general management and character of the skilled and unskilled workmen required for the conduct of all its operations.

Pittsburg District

The description of the Johnstown Cambria Company will enable us to understand the steel industries, on a much larger scale, clustered about Pittsburg. At Pittsburg and at about twenty-four neighboring towns lying in the valleys of the two rivers near their junction are the great manufacturing plants of the Pittsburg district. Several of these individual plants are each larger



Pittsburgh.

than the Cambria steel plant. For example, "The Edgar Thompson Steel Works" are able to produce yearly about 1,500,000 tons of pig iron, 1,000,000 tons of steel ingots, and 900,000 tons of steel rails. The Homestead Works produce 1,500,000 tons of steel of various grades. "The Du Quesne Works" "furnish annually 750,000 tons of pig iron, 600,000 tons of Bessemer steel, and 820,000 tons of blooms, billets, bars, and slabs." Another of the largest producers is the Jones and Laughlin Steel Company. Other great companies are The Crucible Steel Company,

which manufactures high grades of superior steel, The Carnegie Steel Company, The National Tube Company, The Pressed Steel Car Company, the Keystone Carwheel Company, and many others.

It would probably not be an excessive statement to say that the Pittsburg district turns out iron and steel products which would amount to about seventeen or eighteen times the product of the Cambria Steel Works at Johnstown. In the *Review of Reviews* for January, 1905, in an article on Pittsburg, we read that "Ninety million tons of freight were handled [in 1903] on the railroads and rivers of the Pittsburg district."

In order to get some faint idea of the vastness of this traffic, centring chiefly in the iron and steel business at Pittsburg, it is necessary to resort to unusual devices for illustration. One writer suggests a comparison with the bulk of the great pyramid of Egypt, Cheops, which cost the constant labor of one hundred thousand men for twenty years, and contained eighty-five million cubic feet of stone and weighed seven million tons. "Nevertheless Pittsburg's industries, modestly nestling among the gently rolling hills and beneath precipitous bluffs, transport many miles to and fro, raise and lower hundreds of feet, and transform yearly into the bones and sinews of civilization the weight of a dozen great pyramids."

The natural advantages of the Pittsburg district for iron and steel production are great. When the iron works were first established at Pittsburg, all the chief elements for producing iron were found in the neighboring hills (iron ore, coal, and lime). At the present time the iron ore is not obtained from this region because better and

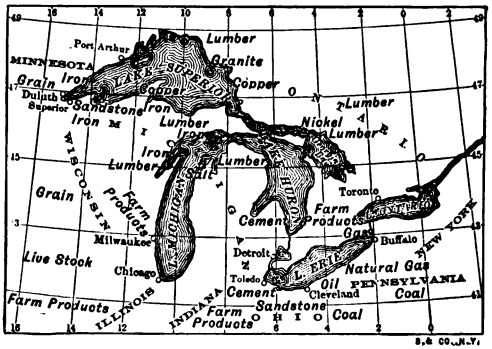
far richer iron mines are found in Michigan and Minnesota and cheap transport is furnished by the lake steamers.

The very rich coal-fields which lie along the Monongahela River and its tributary streams are of boundless value to Pittsburg. The mines which drift into the hillsides along both sides of the Monongahela discharge their coal directly into the coal barges in the river, and this coal is cheaply floated down to the large mills along the stream. At Connellsville is a seven-foot vein of the best coking coal in the world, and after mining and coking, vast quantities of this are shipped to the smelters. In fact, this supply of the finest steam coals is inexhaustible. When it is known that Pittsburg is the centre of one hundred thousand square miles of bituminous coal of the best quality, and that Great Britain has a much smaller coal area that it can by no means mine so economically, we may almost claim that fuel is unlimited. In 1903, the coal tonnage of the Pittsburg district by rail and river was 37,804,192 tons. This is summed up as follows: —

"The principal source of Pittsburg's wealth, as of its mechanical power, is the vast beds of undisturbed bituminous coal, cheaply mined and of the best quality for manufacturing purposes. The Connellsville coking coal belongs to this deposit. It is the most important factor in the success of the Pittsburg blast furnace. A competent authority estimates the still available coal in all of the deposits of this region at over twenty-nine billions of tons, a quantity which would fill thirty continuous lines of freight cars from the earth to the moon" (*Review of Reviews*, January, 1905).

Lime also is found in large beds in the Pittsburg district.

The rivers flowing by the great steel works not only carry this cheap fuel directly to the smelters, but furnish also that vast quantity of water which is needed in the operation of the mills, "it being estimated that the entire average discharge of the Monongahela River is used several times in its course past the steel mills and furnaces of the Pittsburg district." The water is pumped into the mills



Great Lakes Region.

and used in vast quantities in the processes of smelting, in engines and hydraulic presses, and is then returned to the river.

Although Pittsburg has these great advantages of rivers and boundless coal supplies, the richest iron mines for the manufacture of iron and steel are nearly a thousand miles away, along the southern (Michigan) and western (Minnesota) shores of Lake Superior. These are indeed the richest and most easily worked iron mines in the world. Their ores often contain sixty per cent of iron and lie so near

the surface, and are so broken and pulverized, that they can be scooped directly into the cars.

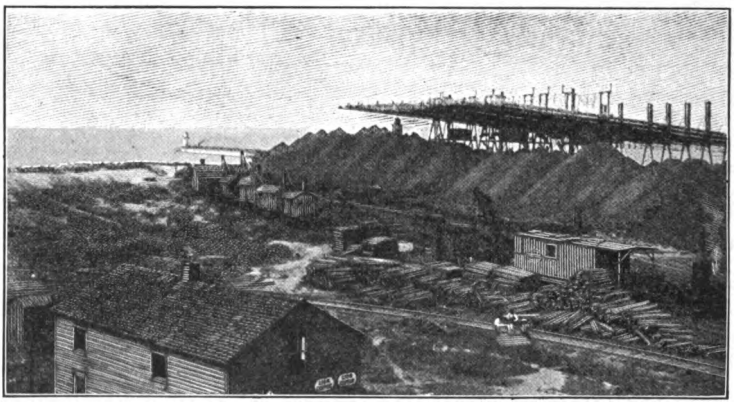
The problem of transporting this ore as cheaply as possible to Pittsburg has led the great iron masters and capitalists of Pittsburg to employ the most ingenious machinists and inventors in discovering and constructing a whole series of great machines and vessels for handling and transporting iron ore. First of all, in the open mines or quarries of Lake Superior, trains of cars are run directly into the great pits and quickly loaded by steam shovels. "At the mines steam shovels capable of lifting five tons of ore at each stroke will load a twenty-five-ton car in two and a half minutes, or at the rate of six hundred tons an hour. This work has actually been done at the rate of fifty-eight hundred tons in eight hours, and this with the labor of but eight men at a cost of but five cents per ton for labor. The supply is enormous, a single corporation having recently estimated its holdings at five hundred million tons, valued at as many million dollars."

As the mines are located a thousand or more feet above the level of Lake Superior and as the slopes toward the lake are gradual it is an easy and convenient haul from the mines to the lakes and docks.

"The mines are located in Minnesota, Wisconsin, and Michigan. Their output is shipped chiefly from the harbors of Duluth, Superior, Presque Isle, Two Harbors, Ashland, Marquette, and Escanaba." At these places are found enormous docks, with all the machinery for the quick and cheap handling of ore. "When the ore trains reach Lake Superior, special, automatic, quick-acting machinery unloads the ore direct into lake steamers built

for this particular work." That is, the ore is dropped by chutes directly into the vessels lying by the great ore-loading wharves.

The largest lake vessels carry from seven thousand to nine thousand tons of ore. Four large vessels built by the American Steam Company and now owned by the American Steel and Wire Company are five hundred feet long and can carry about nine thousand tons each.



Iron Ore Docks at Conneaut.

Most of this ore for Pittsburg is delivered to the ports along the southern shore of Lake Erie, as Lorain, Cleveland, Ashtabula, Conneaut, and Erie, whence the greater portion of it is shipped by rail to the Pittsburg district, enough at least, to produce about seventeen million tons of steel and iron a year. It is at these lake ports that the greatest machinery has been invented and set up for unloading the lake vessels. The automatic ore unloaders built by Mr. Carnegie at Conneaut have giant scoops which lift

ten tons at a time and are expected to unload the largest lake vessels of nine thousand tons in six or seven hours. The heaviest engines and fifty-ton cars carry this ore to Pittsburg. Mr. Carnegie built a special ore and coal-carrying railroad, from Pittsburg to Conneaut, supplied with the largest steel cars and heaviest engines ever built.

On account of these remarkable improvements in transportation, both by lake and by rail, and the great machines for transferring ore from cars to boats and *vice versa*, the direct labor of men is little required, and the rich ores of the Superior district can be transferred a thousand miles at the least expense.

In the vast iron and steel works at Pittsburg a like economy has been practised in the invention and use of electrical machines and engines for the swift and easy handling of the heavy charges of molten metal and the large ingots as they travel through the rolling mills. "In the first place, to reduce handling and transshipment to a minimum, the processes are made as far as possible continuous. The erection of a typical modern steel works will call for a plot of ground which is rather a parallelogram than a square, and there are in the country to-day works that on a width of a quarter of a mile will extend for a mile and a quarter in length. At the upper end will be the stock-yard with its artificial mountains of ore and coke; next the blast furnaces; then the Bessemer converters or the open hearth furnaces, as the case may be. Then will come the soaking pits for heating the cast ingots. Beyond there will stretch one building of a thousand feet or more in length, with its blooming rolls and shears, roughing rolls, finishing rolls, and steel saws succeeding each other

in orderly succession, until at the end of the building one can see the finished product being loaded into the cars almost before the last trace of the furnace heat has gone out of it. Moreover, in its long journey through the mills the material has been rolled and heated, and rolled again, positively with no manual labor whatever; and for the great tonnage that they turn out in a single day, the continued processes are carried on with such rapidity that the journey of a thousand feet or more through the mills is made in one single heat." (*Scientific American*, December 12, 1903.)

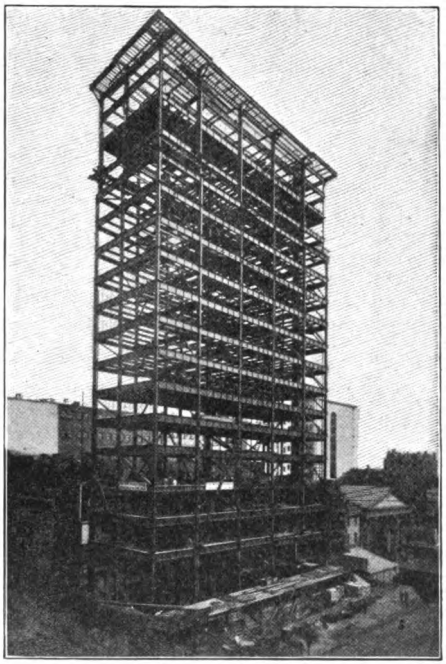
The shipping advantages of Pittsburg for receiving and sending out freight are very unusual. The Ohio River from the early times has been a very cheap outlet toward the west and for the whole Mississippi Valley. The Monongahela and Alleghany have been greatly improved by slack-water navigation. The great railroad systems, like the Pennsylvania lines east and west of Pittsburg, connect it with New York, Philadelphia, and Baltimore to the east and with Cincinnati, St. Louis, Indianapolis, Chicago, and Cleveland toward the west, while a whole group of roads radiate from Pittsburg to Buffalo, Erie, and other large cities on the south shore of Lake Erie. Other great trunk lines extend westward through Ohio, Indiana, and Illinois, while others follow the Ohio and Monongahela southwest into West Virginia and Kentucky.

The project of a ship canal connecting Pittsburg with Lake Erie has been much discussed. Congress has voted favorably upon such a ship canal, with fifteen feet of water, reaching from Ashtabula on Lake Erie to Pittsburg, via the Mahoning, Beaver, and Ohio rivers. This would open to

Pittsburg the commerce of the Great Lakes. "The enormous tonnage offered the railroads by Pittsburg steel mills naturally makes that city one of the important railroad centres of the United States. Ten thousand cars of freight are handled daily, and yard provisions have been made for 60,000 cars. Within the last two or three years one of the leading lines has been compelled to spend $21,000,000 entirely on terminals to prevent freight congestion, and in doing this a 100-mile belt line, about the Pittsburg business district, has been perfected with yards containing 350 miles of track. In six years, four railroads expended for wages, improvements, supplies, and equipment in Pittsburg, $256,575,531." (*Review of Reviews*, January, 1905.)

In spite of the enormous concentration of iron and steel production at Pittsburg, there are several important centres in the United States which compete with Pittsburg in iron production. First are the cities along the Great Lakes. Chicago, Toledo, Cleveland, Lorain, Ashtabula, Conneaut, Erie, and Buffalo have extensive blast furnaces and are very favorably situated for obtaining iron ore and coal, and for shipping iron products. All the cities on the south shore of Lake Erie have been rapidly developing their iron industries. Mr. Carnegie planned to establish a $12,000,000 tube works at Conneaut on the lake so as to secure a back haul of coal for his railroad carrying ore to Pittsburg. Chicago has at South Chicago very large steel works, and is within easy reach of the Superior ore regions and of the Illinois coal-field. The probability is therefore that the Lake cities will grow in importance as iron and steel manufacturing centres. In eastern

Pennsylvania, also, at Lebanon, Bethlehem, and Steelton, near Harrisburg, are great steel plants which are supplied with ore from eastern Pennsylvania, New Jersey, and New York. A study of the tables of iron production will show that eastern Pennsylvania, New York, and New Jersey still produce about two million tons of ore yearly. These eastern iron and steel works have the advantage of easily supplying the eastern market and also of being near the great cities which ship to the foreign market.



Steel Frame of Building.

Birmingham, Alabama, is the present centre of the largest known iron deposits of the United States next to the Superior district. This region of Alabama, Tennessee, and Georgia produced in 1902 nearly five million tons of iron ore. At Birmingham, coal, iron ore, and lime are found near together, so that all the raw materials are present without expense of shipment.

In the Rocky Mountain states also the tables will show a considerable production of iron ore, especially in Colorado and a few neighboring states. The following table will indicate the production of iron ore by states for 1902, as taken from a report on iron ore by John Berkinbine: —

	Long Tons	Value
Minnesota	15,137,650	$23,989,227
Michigan	11,135,215	26,695,860
Alabama	3,574,474	3,936,812
Virginia and West Virginia	987,958	1,667,456
Tennessee	874,542	1,123,527
Pennsylvania	822,932	1,225,453
Wisconsin	783,996	1,800,864
New York	555,321	1,362,987
New Jersey	441,879	1,228,664
Georgia and North Carolina	364,890	505,488
Nevada, Utah, New Mexico, and Wyoming	362,034	475,316
Colorado	306,572	1,084,424
Kentucky	71,006	86,169
Missouri	66,308	106,379
Connecticut and Massachusetts	29,093	81,374
Maryland	24,367	41,976
Ohio	22,657	41,976
Texas	6,516	6,434

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COTTON MILLS AND COTTON MANUFACTURE

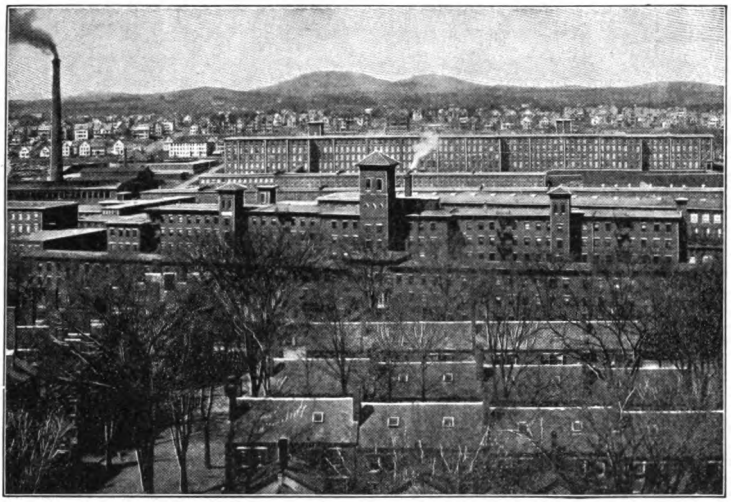
THE manufacture of cotton goods in the United States was first carried on extensively in New England. The two most important centres of this industry, almost from the beginning, more than eighty years ago, have been Lowell, with other cities along the Merrimac River, and Fall River, with its neighboring towns in Massachusetts and Rhode Island.

Map of Manufacturing Cities of New England.

A company of Boston men wished to make use of the canal and water power on the Merrimac. The farm lands along the river and the water-power were bought up and a town was laid out upon the present site of Lowell. In 1826 the town of Lowell was incorporated, with a population of 2500. Several large cotton mills were built, and the town grew so rapidly that in 1836 it had 17,900 people. By 1845 all the big mills had been built and the population had increased to 30,000.

The oldest and largest of the Lowell mills was that of

the Merrimac Manufacturing Company, first organized in 1822. At present it has 144,000 spindles and 4170 looms and 2200 employees. Its printing works, with 22 printing machines (for printing calicoes and other cotton goods), require 1000 employees. Its capital is $2,750,000. In



Cotton Mills.

this large mill the entire process of spinning from raw cotton to weaving and printing was developed under one management. The raw cotton came from the Southern states, while the power was supplied by the river.

In 1845 there were 33 mills at Lowell. About one-third of the population (10,000) were operatives in the mills, 3000 were men and more than 6000 were young women. The young women were respectable daughters

of New England farmers, and after working two or three years in the factory they returned to their homes with a goodly sum of their savings, married, and settled down as farmers' wives. There were about 550 boarding-houses, built by the companies, and well regulated. Any disorderly or immoral person was dismissed, and the companies took great pains to give the young women healthful surroundings and the best influences. "It is probably true that the factory population of Lowell in the early days of the town and city was of a higher intellectual and moral tone than was ever before or has ever since been seen in any similar community in the world's history." ("The New England States," Vol. I.)

During these years the factory girls managed and published a periodical known as the *Lowell Offering*. A church was also built by one of the companies for the special benefit of the employees.

In the last sixty years Lowell has undergone many changes. The influx of foreigners has changed the character of the mill operatives, so that the farmers' daughters are no longer relied upon mainly for help in the mills.

The city of Manchester, farther up the river, in New Hampshire, has some of the largest cotton mills in the United States. They were recently described by an Englishman, Mr. T. M. Young, in his report on "The American Cotton Industry."

"None of the manufacturing towns of New England pleased me so much as Manchester. It has clear air, clear waters, and sunny skies. Almost every street is an avenue of noble trees. And as if all these green trees were nothing, the citizens have given themselves public parks, or gardens, on a scale of unexampled generosity.

"Perhaps the handsomest, certainly the most impressive, buildings in Manchester are the Amoskeag and the Manchester mills. They are built of a warm brick, beautifully weathered, and form a continuous curved facade or front nearly half a mile long. Rising sheer out of the deep, clear, swift-flowing stream, upon the other bank of which are grass and trees, they look like ancient colleges.

"First come the Manchester print works, new buildings containing 17 acres of floor space, and 17 calico-printing machines; then the Manchester mills where there are 3250 looms with a proportionate number of spindles; and finally the Amoskeag Company's mills, 11 of them, containing 11,000 looms and between 300,000 and 400,000 spindles.

"The Manchester mills and print works draw 3000 horse-power, and the Amoskeag mills 8000 horse-power, from the river. Sometimes the mills are stopped for a day or two in winter, when the river rises so high as to cause back pressure on the turbines; but there is never any stop on account of drought. The water-power is supplemented by steam; the coal comes by boat from Portsmouth, 30 miles away, and costs from $3.75 to $4.00 per ton at the mills. The manufactured goods are sent from Manchester to Boston, a distance of 50 to 60 miles, at a rate of 8 cents per hundred pounds and to New York, partly by sea, a distance of 350 miles, for 19 cents per hundred pounds."

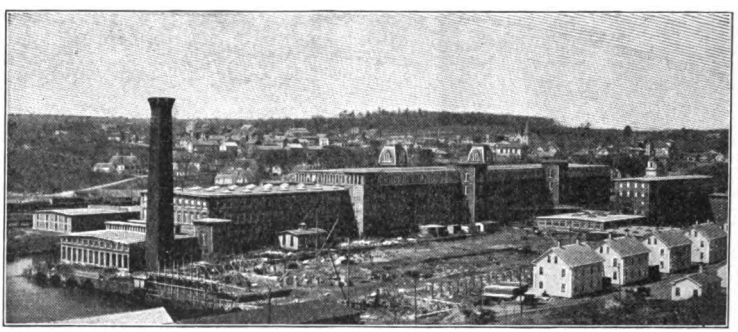
During the month of July, 1896, 2770 employees received $70,455, an average of $25¼ for men, women, and children.

In a population of 65,000, Manchester has 22,000 French and 15,000 Germans.

Near the mills are large boarding-houses for mill girls.

In one of these "the ground floor of the house contains at one end a parlor cosily furnished with carpets, curtains, arm-chairs, lounges, a piano, pictures, and bric-à-brac." The girls pay $2.25 a week for board, and have the use of bathroom, parlor, and private bedroom. The bedrooms are comfortable and well carpeted. The mill company requires that the board be plentiful and of good quality.

Beautiful lakes and wild woods are within an easy street car ride. Manchester presents, therefore, the factory life at its best.



Factory Village, Rhode Island.

At Fall River, Massachusetts, near the boundary of Rhode Island, are located the greatest group of cotton mills in the United States. Fall River has special advantages for the manufacture of cotton cloth. First, the very moist climate near the seashore — excellent weaving weather — is favorable to the processes of spinning and weaving. Second, the deep harbor affords an easy entrance for ships bringing cotton from the South, and for vessels carrying cotton goods to other parts of America and the world.

Third, there is a fine water-power furnished by a series of ponds or lakes. Fall River, the outlet of these lakes, drops one hundred and thirty feet in half a mile. Fourth, the city, with more than one hundred thousand people, supplies plenty of operatives to work in the mills.

"The first cotton mill at Fall River was built on the side of the stream in 1813, and was driven by a water-wheel, and for the next fifty or sixty years every mill that was built was placed by the side of this remarkable water-power. Some thirty years ago all the suitable sites on the Fall River had been occupied, and since then the mills have been built beside the ponds and along the harbor. Few, if any, of the Fall River mills are now driven exclusively by water.

"Here are established 40 corporations with an incorporated capital of $24,000,000, probably representing an investment of $47,000,000, owning 87 mills and employing 30,000 hands. The mills contain over 3,000,000 spindles and nearly 76,000 looms, and are converting 370,000 bales of cotton into 866,000,000 yards of cloth each year. They pay in wages $215,000 a week, giving an average wage of over $7. Fall River claims to produce two miles of cloth in every minute of every working day of the year. Its mills, though mainly employed in the manufacture of print cloth, make every sort of cotton textile, from rough shoe linings to the finest dress materials — twills, jeans, sateens, lawns, leno and lappit cloths, with silk weft, fine zephyrs, lace curtains, and crochet and Marseilles quilts. And Fall River not only spins and weaves these fabrics, but bleaches, prints, and finishes them. Its industries support a population of 105,000 people, of whom the last census showed only

15,000 to be of American parentage. Of the rest, 15,000 are English, 25,000 Irish, 30,000 French Canadian, 5000 Portuguese, and about 15,000 of Armenian, Russian, Italian, and other foreign parentage." ("The American Cotton Industry." T. M. Young.)

The manufacture of cotton had gained a good foothold in the Southern states before the Civil War, but since then, in quite recent years, there has been a rapid growth of factory industry. Mr. T. M. Young says: "If you describe a circle about Charlotte, North Carolina, with a radius of 100 miles, you will have within its circumference nearly 300 cotton mills, containing 3,183,350 spindles and 81,404 looms. The estimated number of cotton spindles and looms in the Southern states on January 1, 1902, was 6,250,000 spindles and 130,000 looms, therefore 50 per cent of all the spindles and 60 per cent of all the looms in the South are within 100 miles of Charlotte. There is very nearly twice as much cotton textile machinery within the circle to-day as there was six years before" (1902).

"In Columbia, congregated at one end of the city, are half a dozen cotton mills, some large and new, others smaller and older, and in the newest mills may be seen at once the advantages and disadvantages attending the manufacture of cotton goods in the South. One of the advantages is the newness of the mills as compared with the mills of the North; for they have started with the most perfect machinery and the most approved methods of construction, arrangement, etc., whereas the older Northern mills are either old-fashioned in these respects or have been brought up to date by the expenditure of much additional capital." But in some cases it is difficult to secure

capable help, and even young children are sometimes employed to run the machines. In other places in the South mill hands are easily found. "The superintendent assured me that plenty of help was obtainable from the farms in the surrounding country. In the Piedmont section, he said, the farmers brought up large families for almost nothing; the farms produced their food; the cost

Cotton Depot in the South.

of clothing in the South, where men work in a cotton shirt and a pair of cotton trousers for nine months in the year, was very much less than in the North; and fuel, when it was needed, could be had for nothing in the nearest wood.

"Augusta, just within the borders of Georgia, and sixty or seventy miles southwest of Columbia, is one of the oldest and most considerable seats of the cotton manufacture

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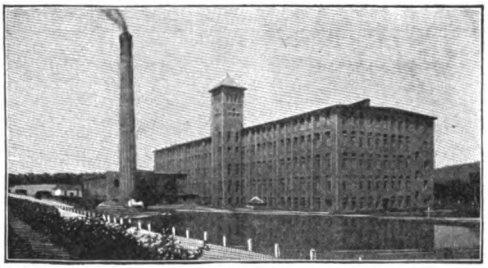
in the South. The city was founded beside the falls of the Savannah River in 1735, and it is mainly to the power of these falls that it owes its nine cotton mills and the comparative prosperity of its 40,000 inhabitants. The construction of the Augusta power canal was begun by the city in 1845, and its enlargement was completed in 1875. Fourteen or fifteen thousand horse-power are developed and sold to the industrial establishments of the city at $5.50 per horse-power per annum, a rate which is said to be the lowest in the United States." (T. M. Young.)



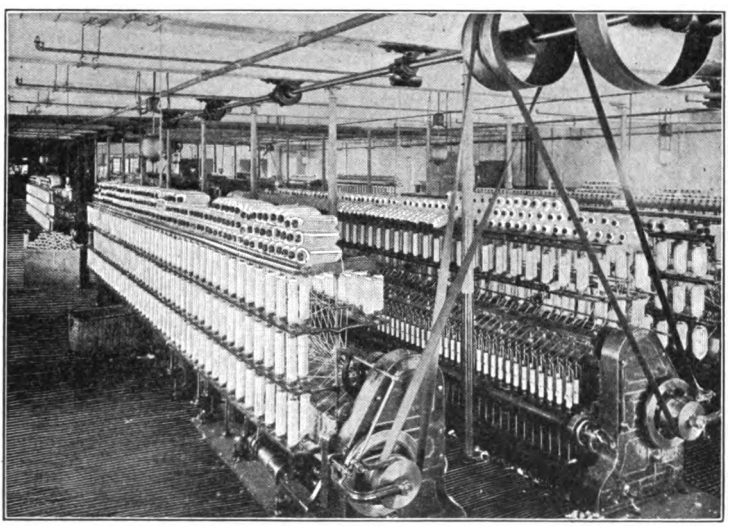
A Cotton Factory at Huntsville, Alabama.

At Atlanta, New Orleans, and other cities in the South, cotton mills have been extensively developed, and the South as a whole is now competing vigorously with New England for the great trade in cotton goods.

It is difficult to understand the complicated processes and machinery of a large cotton mill, even when one watches closely the noisy machines at their work.

In order to convert cotton into cloth two principal things are required. First, to change baled cotton into yarn or thread, and second, to weave threads into cloth. At first glance this may seem to be a very simple matter, and the old-fashioned methods of spinning and weaving were simple. But in a cotton mill a whole series of com-

plex machines is employed for no other purpose than to produce a good cotton thread. There is no problem upon which more ingenuity has been spent than that of making a good cotton thread by machinery. In England and America especially many of the most brilliant inventors have spent the best years of their lives in devising and improving spinning and weaving machines.



Cotton Spinning.

When the cotton bales from the South reach the mills of New England, they pass through several processes before they are brought into shape for spinning. First is the mixing of cotton from many different bales so as to get uniformity. This is done by spreading out the cotton from one bale after another on the floor in successive

layers. Second, this cotton as it comes from the bales has been tightly pressed and matted together. It needs to be loosened up, and all fragments of leaves, seeds, and dirt shaken out. This is accomplished by a powerful machine called an *opener*, which pulls the cotton to pieces and subjects it to a rapid beating, followed by fanning with currents of air which drive out the dust, dirt, and impurities. It finally passes between rollers and is wound in thick sheets upon a cylinder. This sheet is called *lap*.

The carding machine now receives this lap as it is uncoiled in broad sheets and carries it over a series of rollers which are thickly set with steel wire teeth. These comb out the cotton fibres and with the assistance of a beating motion shake out the dust and the broken ends and fragments of poor cotton.

As this soft, loose-fibred, and well-cleaned cotton is stripped off from the cylinder of the combing machine, it is gathered into a loose, untwisted cotton strand or rope called a *sliver*, about an inch in diameter, and as it drops from the machine is coiled into a tall can.

Sometimes a combing machine is next used to comb out poor and short fibres in producing the finest quality of yarns. But usually the drawing frames are now employed to put the sliver into better shape for spinning. For the soft cotton sliver is not yet ready for spinning. The delicate cotton fibres are still crossed and tangled, and must be drawn out parallel with each other. This straightening out of the fibres so that they stretch parallel to the length of the sliver is accomplished by running the slivers through a series of four pairs of rollers. The second pair of rollers, revolving more rapidly than the first, seize the thread ends

and stretch them forward. The third pair of rollers, moving still more rapidly, pull the fibres out still farther so that they become parallel, and the fourth pair of rollers give a still longer stretch to the threads, so that by the time the sliver passes through the last roller it has been pulled out to six times its original length. One foot of sliver would be stretched out to six feet in length.

Six of the slivers are run through the series of rollers together, and as they come out from the last pair of rollers they are brought together again as one sliver. As these six thin and delicate slivers are brought together, a weak spot in one is strengthened by being brought alongside the strong fibres in the other five, so that much greater uniformity of strength is given to all parts of the final sliver. The two chief ends arrived at in the drawing frames (and rollers) is to stretch out the fibres parallel to each other and to strengthen any weak spots in the sliver, so as to make the thread of uniform strength. The soft cotton slivers are usually run one after another through three sets of these drawing frames as described above, each process giving still greater parallel stretch and uniformity of strength to the final sliver.

The finally perfected sliver is next put through a set of machines, the bobbin and fly frames (sometimes called slubber and roving frames). Their purpose is to gradually stretch out and reduce the size of the sliver, and as it grows smaller and more delicate, to give it a slight twist to prevent breaking. It is also skilfully wound upon bobbins in readiness for the spinning machines.

This slight twist which is finally given to the sliver is

really the beginning of the spinning process. "Without twist there would be no cotton factories, no cotton goods, none of the splendid and gigantic buildings of one description or another which are found so plentifully intermingled with the dwellings and factories of large cotton manufacturing towns." ("The Story of the Cotton Plant," Wilkinson.)

All these complicated machines and processes above named are merely the preparatory steps for getting cotton ready for spinning. Spinning proper is chiefly carried on to-day by two kinds of machines, the spinning-mule and the ring spinning-machine, both of which are too complicated to be described here.

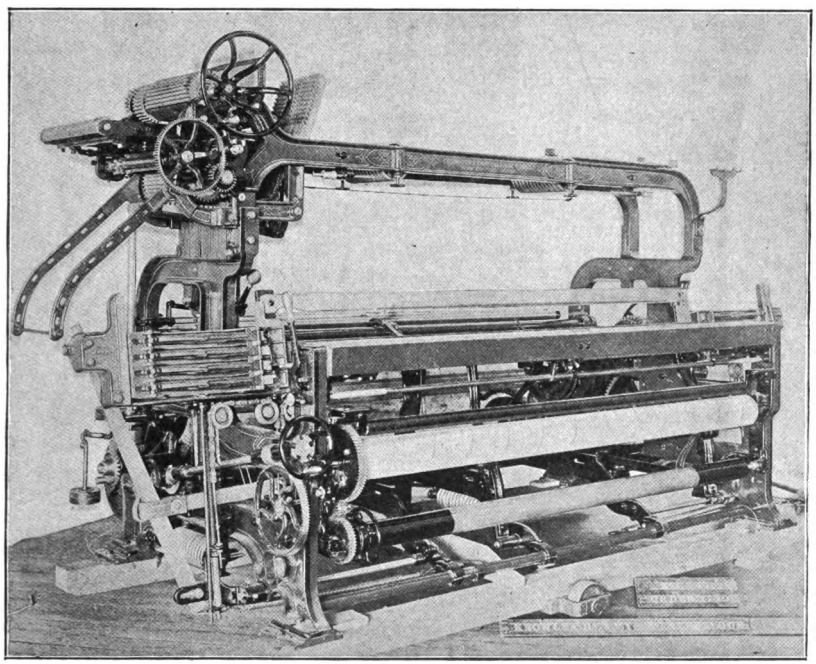
The history of these machines since the days of their first invention by Hargreaves, Arkwright, and Crompton in England (1765 and 1780), together with the improvements which have been made in them from time to time, would bring out the chief points in the growth of the art of spinning, and of the great industries founded upon spinning both in Europe and America.

"The self-actor mule of to-day represents and embodies the inventions of hundreds of the most intelligent men ever connected with any industry in the world's history. It is universally acknowledged to be one of the most wonderful and useful machines ever used." ("The Story of the Cotton Plant.")

In the big cotton mills, the yarn which is the result of the spinning processes above mentioned is woven by the power looms into cotton cloth, such as muslins, sheetings, and calicoes. The calicoes and ginghams, however, require the additional processes of dyeing and printing,

which form an important department of some of the large cotton mills.

The power loom was invented in England in 1785 by Edward Cartwright, and together with the spinning-ma-



Loom.

chine already mentioned formed a complete series of great machines for the production of cotton cloth. When we add to these the cotton gin, invented by Eli Whitney in 1794, for the separation of the cotton from the seed as it comes from the plantations, the circuit of manufacturing

is complete from the cotton field to the finished products of the mill, — the fine muslins and laces.

The Northrop automatic loom has been recently introduced as one of the most perfect for weaving. "The essential difference between it and a common, or any other automatic loom is, that when the weft breaks or is exhausted, the shuttle is automatically recharged with weft and threaded without being removed from the sley." This loom is the invention of an Englishman, James Northrop, but it is manufactured in America by a company at Hopedale, Massachusetts.

"The weaving shed of this mill [a large mill in Rhode Island near Fall River] was a wonderful sight. Here on the floor were 2743 looms, and one's first impression on entering the room was that one was looking at a room full of looms and nothing else. Not a strap was visible, for the looms are all driven from shafting in the basement. In the centre of the shed was a sort of raised platform or observatory, from which a bird's-eye view of the whole room could be gained, and looking out from this point over the great wilderness of the clanging machinery, one saw that it was not absolutely a solitude." A few weavers were in sight to manage the machines. For the 743 common looms there were about 100 weavers, for the 2000 Northrop looms there were 134 weavers.

The shops engaged in the manufacture of looms and other cotton mill machinery are in themselves great establishments. The works of the Draper Company at Hopedale, Massachusetts, turn out the Northrop looms. "The works at which the Northrop loom is made in America employ from 1700 to 1900 men, and are now mainly

occupied with the manufacture of these looms and their accessories. In their general design and equipment with labor-saving, machine tools these Hopedale works are a model establishment, and the village which the company has built for its work-people is a model likewise. Eighty-five thousand Northrop looms had already been turned out when I saw the works." ("The American Cotton Industry.")

Previous to the invention of the spinning and weaving machines in England, the old-fashioned hand processes were used, the spinning-wheel for making yarn, and the hand-loom for weaving. In America also the wheel and hand-loom were in use till after the Revolution, and in some of the Appalachian regions of Tennessee and the Carolinas even to the present time. This old-fashioned spinning and weaving was done in private houses in what has been known as the cottage system. But with the invention of machinery and with the use of water-power and later of steam-power in running machines, the factory system was developed. Lancashire in England became the chief place for cotton weaving and spinning, and for more than a hundred years Manchester and its neighboring cities have been the greatest centre of the cotton industry in the world. All the important machines for cotton manufacture were invented in England. Before the Revolution England discouraged manufactures in America, wishing to keep the colonies as a good market for her own manufactures. By acts of Parliament England forbade any one to ship machines or models, or even plans of such, to America and to other countries. Heavy fines and imprisonment were laid upon any one who attempted to export such

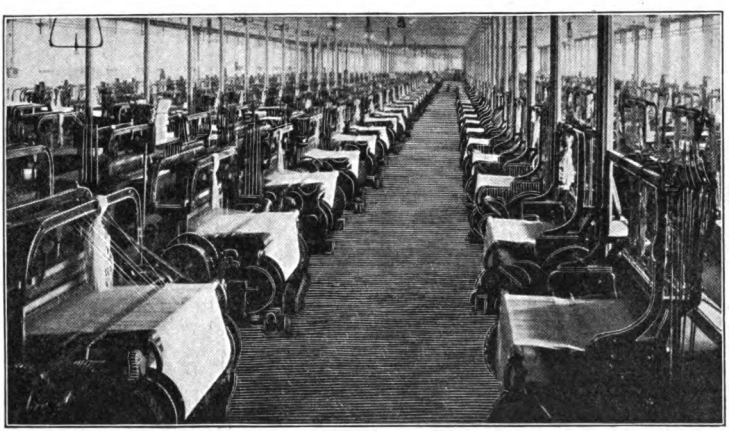
machines or models to America. During and after the Revolution, Americans became anxious to manufacture their own cloth, and they were very eager to secure the newly invented spinning machines and looms in use in England. Finally Samuel Slater, a young Englishman who had worked in the English mills and had made himself well acquainted with all these machines and their construction, came to America in 1789. He was not allowed to bring any machines or descriptions of them. But he had worked as an apprentice, and afterward as foreman, in setting up and using the machines in England. He therefore carried all these plans in his head across the ocean, and at Pawtucket, Rhode Island, in partnership with Brown and Almy he built, largely with his own hands, the Arkwright machines for spinning cotton. Thus in 1790 he became the founder of the factory system in the United States.

The factory system as a complete system was worked out earlier in the United States than in England. It has been the custom in England to carry on the processes of spinning in one factory and to transfer the weaving of cloth to a distinct establishment. The two processes have been kept apart. But as early as 1814 a factory was completed by Mr. F. C. Lowell at Waltham, Massachusetts, with a full set of machinery for spinning and weaving.

"This factory erected at Waltham was the first in the world, so far as any record shows, in which all the processes in the manufacture of goods, from the raw material to the finished product, were carried on in one establishment by successive steps, mathematically considered, under

one harmonious system." ("Industrial Evolution of the United States." Wright.)

The factory system developed rapidly in the United States from 1810 to 1860, being located chiefly in New England and the Middle states. In 1831, the first year for which we have definite reports, the capital invested in the cotton industry was $40,612,984, in 1860, $98,585,269.



Cotton Weaving.

In 1860 the value of cotton goods produced in the country was $115,681,774, of which $79,359,900 was produced in New England. During the period from 1860 to 1890 the whole capital invested in the cotton industry increased from $98,585,269 to $354,020,843. There were less establishments in 1890 than in 1860, but they were far larger, showing the concentration of labor and capital in large factories in the chief centres of the industry. Even in the South, mills had been established before 1860, and since

the Civil War their number has greatly increased. In 1894 about 700,000 bales of cotton were worked up in southern mills.

The concentration of spinning and weaving in great factories in the midst of populous cities like Fall River, Cohoes, N.Y., Lowell and other cities along the Merrimac, at Charlotte, Columbia, Atlanta, and other southern cities, has done away with household spinning and weaving, and has brought about the factory system with wealthy mill owners and thousands of factory employees. The rapid growth of this great industry has been marked by a constant improvement in the machines for spinning and weaving.

Skilled workmen are required in some departments of the spinning and weaving. Men are usually employed in working the spinning-mules. But the ring spinning-machines, which now compete with the mules, can be run by young women with less strength and skill. The self-acting automatic loom, requiring little skill, has enabled the mill owners to dispense with the aid of skilled workmen. Immigrants from Europe are also able to handle the new machines successfully. "The constant flow of immigrants from Europe and from Canada, many of whom cannot speak or understand English, makes any efficient union of labor in the cotton mills impossible, and an added difficulty is the rapid movement of labor, not only from place to place but from trade to trade. The mule spinners alone — mule spinning being a highly skilled craft — are well organized; but mule spinning is being gradually abandoned by American mills in favor of ring spinning, for which cheap and comparatively unskilled labor can be employed.

"The mule spinners, said one superintendent to me, are a tough crowd to deal with. A few years ago they were giving trouble in this mill. So one Saturday afternoon, after they had gone home, we started right in and smashed up a room full of mules with sledge hammers. When the men came back Monday morning, they were astonished to find that there was no work for them. The room is now full of ring frames run by girls." ("The American Cotton Industry.")

From one mill in Maine sixty thousand mule spindles had been thrown out partly because the mule spinners were troublesome to deal with and partly because ring spinning is regarded as cheaper.

"I was told that one of the mills at Lowell bought recently 1000 new automatic looms, and the loom makers took in part payment the thousand non-automatic looms which were displaced by the change. Many of these looms were in prime condition, and their value may easily have been $30,000; but the automatic loom makers who bought them by exchange broke them up carefully into small fragments in order that they might never be in the market in competition with their own automatic loom." ("The American Cotton Industry.")

The rapid changes that take place in the mill population, due partly to the use of new machinery, partly to the need for cheap labor, and partly to the immigration from Canada and Europe, are well illustrated by the following statement: "Even a good mill in New England loses five per cent of its work-people every week, and has to find substitutes. There are towns in Massachusetts whose cotton mills thirty or forty years ago were filled with

American-born workmen of a very good class, earning wages higher than are paid even to-day. As wages gradually fell by successive 'cuts' to the low level of 1898, these towns were swept by waves of foreign invasion. Weavers from England and Scotland first drove out the Americans, only to be driven out in turn by an army of Irish. The Irish began after a while to be troublesome, and crowds of French Canadians were summoned from over the border to take their places. Even the docile 'Kanucks' have now given way in some places before the invasion of Portuguese, Greek, and Syrian immigrants and the mill superintendents are wondering what will come next. I have seen in some mills notices printed in four languages, and orders are given by gestures or through interpreters. The labor displaced by immigration rises to better things, and the expansion of American industry provides at present openings for all." ("The American Cotton Industry.")

There are several evils that easily spring up in the mills of factory towns, the correction of which requires the authority of the state. The mill companies sometimes fail to provide properly against dangerous accidents caused by machinery. They neglect to provide proper ventilation, and good sanitary arrangements, which are necessary to the health of employees. Children are often employed in mills when they are too young, and ought rather to be in school. Against these evils the legislatures of the several states where the factory system prevails have passed laws, and regular officers are appointed to inspect the mills and see that the laws are enforced.

Mr. Rufus C. Wade is chief inspector of factories and

workshops in Massachusetts. "He has a staff of twenty-six inspectors, two of whom are women, employed exclusively in connection with textile factories, and their duties are to see that machinery is properly fenced, to look after the safety of elevators, to inspect the sanitary arrangements of the mill, to see that all young persons under twenty-one years of age employed in mills have had or are receiving a proper elementary education, to prevent 'time-cribbing,' and to see that the 'particulars clause' is complied with, so that every weaver may be able to check the amount of his or her wages.

"No child under fourteen years may legally work in a factory, in any capacity, in this state (Mass.), whether as an employee of the firm or as an assistant to its parents. Children over fourteen who cannot read or write simple sentences must, if they work in the daytime, attend a night school until they can read or write, or, failing that, until they are twenty-one years of age. Such children are provided with attendance tickets, which are punched at the school and must be shown to the factory inspector on demand. Birth certificates are not required to prove the age of children, but the parents must sign a sworn statement." ("The American Cotton Industry.")

In spite of the laws, even in Massachusetts, the conditions are sometimes very unfavorable to the health of operatives. In one of the mills of New Bedford the following description is given: "The weaving rooms were very ill ventilated; there appeared to be no fans to introduce a proper supply of fresh air, it was intensely hot, gas-jets were burning in the middle of the room, volumes of steam were spouting out like geysers from the floors,

and the condensed moisture was pouring down the closed windows. The faces of the weavers looked pinched and sallow, and the arms of many of them were pitifully thin. I do not care how many dollars a week those people may have been earning; they were badly off." ("The American Cotton Industry.")

In North Carolina, in one large mill, "half the people in the mill seem to be between nine and fourteen years of age, and I was told that they worked sixty-nine hours a week." In another southern mill, "The spinning frames were run by children and girls from eight to nine years of age. The firm professes not to employ children under twelve, and I was told that the younger children whom I saw came in to help their sisters. I had met the same thing in the state of Rhode Island, and it is hardly necessary to point out that the difference between employing a child in your mill and employing that child's mother or sister on terms which induce her, with your permission, to call in the child's assistance, is a matter of form, and nothing more. The Massachusetts law, as I have shown in an earlier chapter, meets this evasion by forbidding young children to work in a mill for anybody." ("The American Cotton Industry.") There has been a strong agitation recently in favor of limiting child labor in mills, both North and South.

A large cotton-manufacturing company like the Amoskeag works at Manchester, New Hampshire, or the Merrimac Company at Lowell, Massachusetts, requires a high degree of wisdom and experience in its general management. A large number of difficult and complicated problems must be successfully solved. One of these large companies has invested a capital of two or three millions,

and if its business management is to be successful, it must pay back to the stockholders yearly five or six per cent of profits above all expenses.

A large part of the expense is applied to the construction of mills and their equipment with machinery, with all the lands, water power, or steam engines necessary to a complete working factory. Then the raw material from the South must be purchased from the cotton-producing states, and the coal shipped in from long distances. Expert overseers, machinists, and workers, and thousands of employees, must be secured, managed, and well paid.

It is not enough to equip thoroughly a mill with modern machinery, — a very expensive investment, — but track most be kept of the improvement of machines for cotton spinning and weaving. New inventions must be adopted, and often valuable old machines must be laid aside or broken up to make a place for improved inventions.

Mr. Edward Stanwood in his "Cotton Manufacture in New England" says, "It is not exaggerating greatly to say that the improvements made in all the important machines used in turning cotton into cloth are so frequent and of such value that any cotton mill becomes antiquated in five years unless its old machinery is replaced by new."

The large cotton-mill companies have often had difficulty with strikes among their more intelligent workmen. Labor unions are formed among the operatives for the purpose of keeping wages high and the hours of labor short. On account of these striking workmen the companies have sometimes called in thousands of immigrants, as the French Canadians, the Italians, and others. The improved auto-

matic machines for spinning and weaving require less skilled operatives, and by purchasing these new machines the companies have been able to dismiss their more troublesome skilled laborers, and employ women or foreigners for the easier work with new machines.

One of the chief difficulties of mill owners has been that of overcoming competition, first with England, and secondly with rapidly increasing mills in this country. When cotton factories first began to be established in this country, they had to compete with cheap foreign goods sent from England. In order to help the manufacturers of this country, Congress levied a duty upon foreign goods, especially during the War of 1812. In 1816 a regular tariff of twenty-five per cent or more was laid upon cotton fabrics, and this enabled the American manufacturers to compete successfully with the English goods.

For thirty years under this protective tariff the cotton manufactures of this country flourished and grew rapidly in importance. By 1846 the American factories had become so strong that they were able to stand a considerable reduction of the duties and continue their work. Even before the Civil War the cotton factories had built up a large foreign trade in competition with England.

From the following statement of Mr. T. M. Young it seems that England can secure raw cotton as cheaply as the New England states: —

"New England, as far as I can gather, has no advantage, or very little, over Lancashire in the cost of bringing raw cotton from the South. I have the authority of Mr. S. T. Hubbard, President of the New York Cotton Exchange, for the following facts: Cotton is now being carried to

Europe for less money than to New England. The rate from New Orleans to the Manchester docks on March 8, 1902, was 32 cents, while the rate to Fall River was 38 cents per 100 pounds. Cotton bound to New York and consigned to New England points often pays a higher freight rate than cotton in the same steamer bound for Liverpool or Bremen. Cotton shipped to Liverpool from Newport, Arkansas, pays a freight rate of 62 cents per 100 pounds, whilst the rate to Lowell, Massachusetts, is 75 cents. The railroad companies exercise the right of 'routing' or forwarding cotton to New England by such roads as they (not the consignees) may choose. 'In short,' said Mr. Hubbard, 'the cotton which has gone to Europe this season has been handed to spinners abroad at a lower rate of freight than cotton shipped to spinners in New England.' It is necessary to bear in mind, however, that ocean freights had been exceptionally low, and that the cost of conveying cotton from the docks at Liverpool, or even Manchester, to the mill, would, when added to the ocean freight, remove much or all of the apparent difference in favor of Lancashire."

The old and well established mill companies of New England have been compelled to compete also with the many new factories which have sprung up both in New England and in other states, and, in recent years especially, in the South. In the period between 1842 and 1846 the old mill companies were making large profits. "Mr. Lawrence gave a table of the dividends paid by twenty-six of the leading corporations of Massachusetts and New Hampshire for each year from 1839 to 1849 inclusive. The returns show a marked falling off in the years after 1846. Thus seven Lowell corporations paid during 1839

an average dividend of 8½ per cent. They increased their profits wonderfully up to 1846, when they divided an average of 19½ per cent. Then there was an abrupt and continuous drop to an average of 7 per cent in 1849." (Edward Stanwood.)

The explanation for the sudden drop in prices was that the great profits offered caused many new mills to spring up in the United States, and soon there was an overproduction of cotton goods. There was also a great reduction of the tariff on cotton goods in 1846.

At the close of the Civil War a high tariff was passed by Congress, and again there was a wonderful expansion of cotton factories, especially in 1870 and 1872, and this also was followed by overproduction and depression of cotton manufacture.

The rapid development of cotton manufacture in the South has raised the question whether the Southern states are likely to compete strongly with New England and the Middle states in this great industry.

"At the beginning of this year (1902) the Southern states contained something like 6,250,000 spindles and 130,000 looms. In 1880 there were 180 factories, in 1890 there were 264, in 1900 the total was 663, and the increase in the number of spindles and looms had been much greater in proportion. In 1901, 113 new mills were started, and it is estimated that 135 more will have been completed by the end of 1902. The consumption of cotton in the South has increased fourfold and more since 1887, and is now 40 per cent or thereabouts of the whole consumption of the United States mills.

"The actual cost of producing coarse cotton goods in

the South is undoubtedly less than in New England. The cotton is obtained more cheaply by from one half cent to one cent per pound; the Southern mills, being newer and having less skilled labor, have been equipped to a greater extent with labor-saving machinery, which in some degree neutralizes the difference between skilled and unskilled labor, and enables work to be continued daily for very long hours without so serious a loss of efficiency as would otherwise be inevitable; for the automatic machine never tires, and, as it stops of itself when anything goes amiss, the vigilance of the minder is not so severely taxed. Another point is that the Southern mills have specialized in their work more than the Northern. A typical Southern mill makes far fewer kinds of cloth and spins far fewer sizes of yarn than a typical New England mill. . . . Perhaps the truth is that in some parts of the South where the industry has been longest established, and a generation has been trained to the work, Southern labor is actually as well as nominally cheaper than the Northern; whilst in other districts where many mills have sprung up all at once amongst a sparse rural population, wholly untrained, the Southern labor at present procurable is really dearer than the Northern. In any case I do not think that really cheaper labor can be counted on as a permanent advantage for the Southern cotton mills." ("The American Cotton Industry.")

The great wars in which the United States has been engaged have sometimes been a source of benefit to the cotton factories and sometimes a very serious damage.

During the Revolutionary War and at its close, all Americans were very anxious to learn to do their own manufacturing and not to remain dependent upon the

mills and manufactured goods of England. The state governments and the United States did what they could to encourage the building of cotton mills. Again, the War of 1812 with the period that followed, in which English manufacturers were shut out as much as possible, was the period in which cotton manufacture was encouraged and became firmly established in this country.

The great Civil War, on the contrary, almost completely stopped the manufacture of cotton, first because the cotton trade of the South was closed against the North and little raw cotton could be obtained, and second because the mill operatives in large part were in the northern armies. To show the increase of value of raw cotton during the war the following facts are convincing: —

"Middling upland cotton which sold throughout the year 1860 at an average slightly below 11 cents a pound was quoted at $1.54 a pound in July, 1864. Amoskeag denims, the price of which was 15 cents a yard in 1860, were quoted at 88 cents in October, 1864." (Edward Stanwood.)

In view of all the difficulties and uncertainties connected with the manufacture of cotton goods, — the large amount of capital invested, the rapid improvement and change in machinery, the necessity for cheap raw materials, the difficulties with labor unions and the constant change of employees, the fierce competition with foreign manufactures, and with constantly increasing new rivals at home, the frequent interferences by both state and national governments in regard to factory inspection and tariffs, the constant fluctuation in the prices of both raw materials and manufactured goods, — in view of all these

difficulties, the successful managers of cotton factories must be men of large and comprehensive ability, experience, and energy.

If we should take time to compare the manufacture of cotton goods with that of woollens, we should find that these two principal kinds of textiles have a very similar history and importance. In fact, the manufacture of woollens — hand spinning and weaving — was common in colonial times in all the colonies, before cotton spinning was known. After the Revolution it was difficult to get the superior carding, spinning, and weaving machines that had been invented in England. But skilful English mechanics brought to New England in their heads (as did Samuel Slater) the plans and secrets of the woollen manufacture, and built similar machines here which were the beginning of the woollen industry on a large factory scale. Some of the big mills of Lowell and other cities were both cotton and woollen factories from the start.

Wool manufacture was protected by tariffs, as was the cotton, and had a growth and variety of successes and failures similar to that of the cotton industry.

New England has remained from the start the chief centre of the woollen factories. "The value of the products of New England woollen and worsted mills in 1890 was $139,302,134, and for the whole country was $270,527,511. Of the 157,923 operatives employed, 79,063 were at work in New England; and of the $245,886,743 of capital invested. in woollen manufacture, $134,627,725 were in New England mills. The largest, most perfectly equipped, and most successful corporations in the country engaged in wool are New England institutions." (S. N. D. North.)

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On the other hand, in the weaving of carpets and rugs, Philadelphia has been the great centre of manufacture. "For a variety of reasons the chief seat of this industry is not in New England but in Philadelphia, where more power-loom carpets are produced annually than are made in all European countries combined. But New England, while surpassed by Philadelphia both in the number of carpet mills and in the quality of their product, possesses four of the largest and most successful carpet mills in the world." ("The New England Wool Manufacture." S. N. D. North.)

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NEW YORK CITY

NEW YORK CITY is probably the best known of American cities, because more people are led by business or travel to visit this place than any other in America.

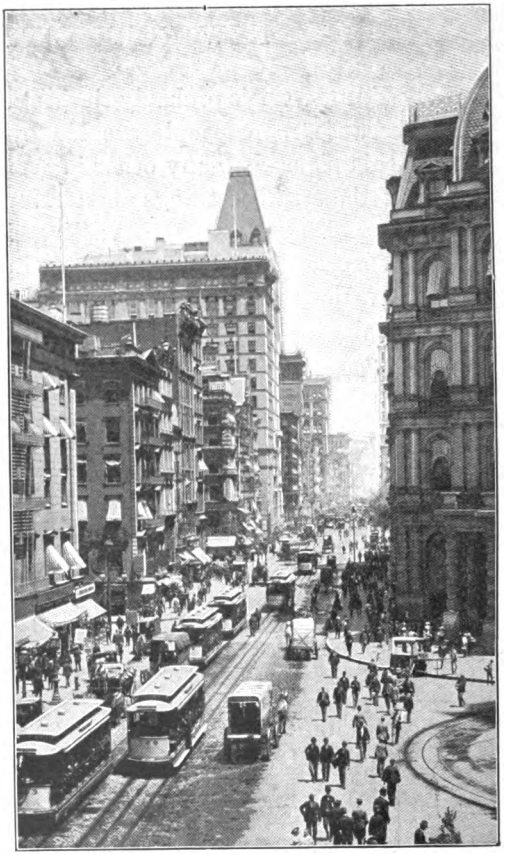
One of the striking things about New York City is its present rapid growth. One visiting it in the last few years is surprised to see so much building and improvement of various kinds. In many places the city streets are blocked with the quantity of building materials. Not only lofty skyscrapers are rising, but large apartment houses, hotels, residences, business blocks, and whole streets of four and five story flat buildings for homes. Besides this, streets are being paved, wharves constructed, bridges built, subways tunnelled, elevated railroads extended, parks laid out, and old buildings torn down and larger ones constructed. One would almost think that the people of New York had gone wild with the fever for building houses and for making improvements.

The reason for this unusual building activity and the employment of tens and even hundreds of thousands of men in building operations is the fact that more houses are needed, people are coming rapidly into the city from all directions, and the present increase in population is very rapid.

If we inquire into the reasons for this growth in population, we must consider the peculiar advantages of New York for the shipment of goods both by land and sea.

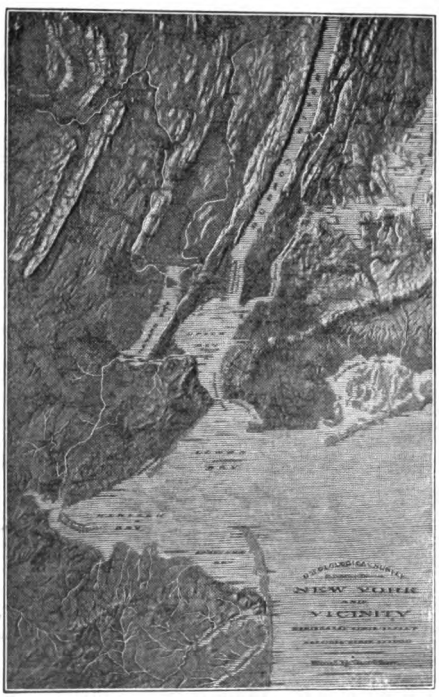
In olden times it was said that all roads led toward

Rome. In a certain sense it may be said that all roads in the United States, and many others, point toward New York City. If we had the power to rise in a balloon high enough above New York City to see a thousand miles in all directions, and could count the number of trains on the railroads moving toward New York City, and then, throwing a glance out upon the broad Atlantic, could count the number of steamships and sailing vessels bound for New York, we should think that everybody must be coming to New York as the centre of the world.



Scene in Broadway.

It is indeed strange, when there are so many other large cities on the Atlantic coast with good harbors and railroads reaching inland, that the quantity of produce going in and out of New York harbor is equal to that of all the other coast cities of the United States on both oceans. We will inquire into the principal causes of this result. The commerce of the United States with European countries is far more important than that with other parts of the world. An examination of the map of the United States as related to the Atlantic Ocean and Europe will show that New York City is the most convenient point from which products coming from Europe can reach all parts of the United States. It might seem at first glance that Boston or Philadelphia or Baltimore might be as favorably located as New York. But an examination of the railroads and



New York and Vicinity.

water routes of the United States will show that it is much easier to ship goods to all parts of the United States from New York than from any other one point. Recall, for example, the great railroads, — the New York Central, the Pennsylvania, the Southern Railroad, besides the Hudson River, the Erie Canal, and the Great Lakes.

On the other hand, vast quantities of corn, wheat, cotton, meats, flour, and other products are all the time pouring forth from the Western states toward Europe; and New York, for the same reasons above stated, is the best outlet for most of these products. A third advantage of New York is its remarkably large and safe harbor, and the many miles of shore line suitable for wharves where the largest vessels can unload and take on cargoes.

It is only gradually with the growth and history of the country that the overwhelming advantages of New York City for both foreign and domestic commerce have come to light. There was a time when Philadelphia was larger, but with the opening of the Erie Canal in 1825, and the development of the great Northwest, the supremacy of New York was assured.

By the census of 1900 Greater New York had a population of 3,437,202, and stood second to London in size among great cities. In 1905 its estimated population was a little more than 4,000,000. This sudden increase of population was due to the fact that New York City, which included only Manhattan and a small part of the Bronx, was extended, in 1898, to include Brooklyn, Staten Island, the Bronx, and Queens County on Long Island. But several large cities like Hoboken, Jersey City, and Newark, while a part of the business life

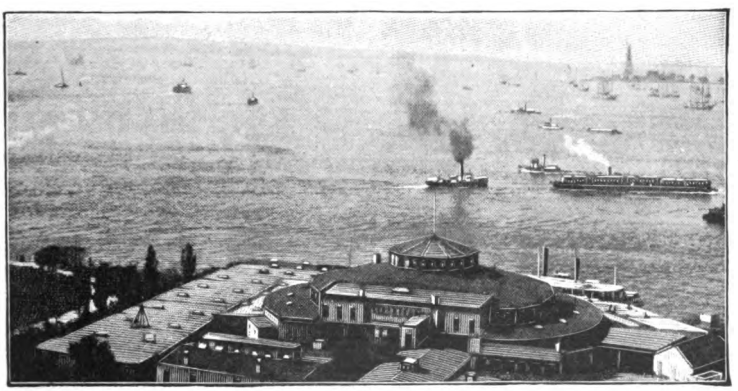
UNIVERSITY OF CALIFORNIA

of New York, are not included in the above figures. It is estimated that within twenty-five miles of the centre of New York there are about five millions of people whose life and business centre in Manhattan Island.

New York City with its great harbor and millions of people illustrates well the most important problems of modern city life.

The Harbor and Commerce

1. The Upper New York Bay, which is the main harbor, is land-locked so as to be perfectly safe against the storms of the ocean. On the east are the hills of Long Island, and on the southwest those of Staten Island, while to the west and north are Jersey City and New York. This bay is no small strait, but a broad expanse of deep water, eight



Harbor of New York.

miles long, and more than five miles wide at the widest part. There is plenty of room in the bay for all the varied

steamers and water craft that find their way to New York from all parts of the world. To the south are the Narrows, opening into Lower New York Bay, which is still larger, and serves as anchoring ground for vessels before entering the main harbor. In this outer bay, on two small islands, are the quarantine stations from which all incoming

Scene at a Dock.

vessels and their passengers are inspected. If cases of small pox, yellow fever, or other dangerous diseases are reported or detected, the patients, and, if necessary, all the crew and passengers, are sent into quarantine at Hoffman Island till all danger is past. The government thus protects the people of New York from diseases and pests which would otherwise be introduced from other cities and countries. Hoffman Island and Swinburn Island were artificially built

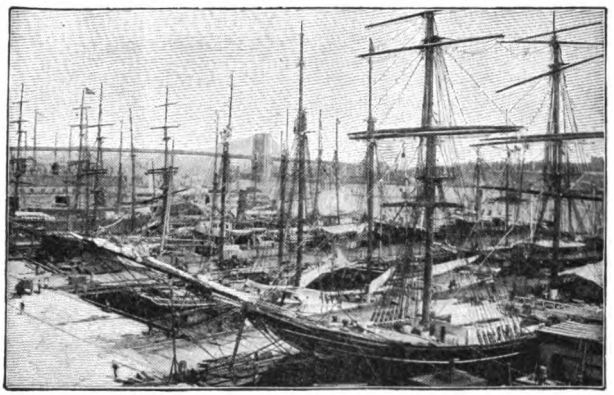
up in the outer harbor, to take care of patients and those detained in quarantine without danger to other people.

From the deck of an incoming vessel entering the Narrows in the evening, the harbor of New York, with its many lights from the neighboring hills, from all sorts of vessels, and from the long arch of illumination on Brooklyn bridge, presents a magnificent sight. A voyage from the Narrows up the Bay to New York is always varied with interesting scenes on the shore and among passing vessels. As a great passenger steamer like the *New York* or *Paris* of the American Line (more recently the *Celtic* or *Teutonic*) moves up through the harbor with its hundreds of passengers from Europe, it meets other ocean steamers just starting for England, or Hamburg, or Naples with loads of passengers. At pier No. 14, on the west side of New York, the great vessel passes into the slip of its own huge dock, where it unloads its cargo and passengers, and awaits the goods and people who, a few days later, are starting for Southampton and Antwerp.

The International Navigation Company, which owns the *New York* and *Paris*, has also a large number of passenger steamers, including those of the American Line and Red Star Line. Several of its vessels sail at stated times every week for Europe, and others arrive in New York from England, France, and Belgium. These large steamers carry both freight and passengers. The *Majestic* of the White Star Line can carry 1200 passengers and 2500 tons of freight and cost in building $2,000,000. One of the freight steamers of the White Star Line carries 9591 tons of freight.

A few years ago there were thirty of these transatlantic steamship lines, whose vessels plied between New York and

European ports, including those of England, Scotland, Scandinavia, France, Germany, and the Mediterranean countries. Besides these there are many other important lines of steamers trading between New York and South America, Africa, India, and all parts of the world, and also a large fleet of tramp steamers, which wander from



Ships in New York Harbor.

port to port picking up such freight and passengers as may offer. Then there must not be forgotten the numberless fleet of schooners and other sailing vessels which are constantly arriving and departing. The coastwise trade of New York with other ports on the Atlantic is also of great importance, and there are several lines of steamers between American ports, as the Clyde Line from New York to Jacksonville, the Mallory Line to Key West and the Gulf, and the Old Dominion Steamship Company to Norfolk and Old Point Comfort. The Fall River Line, plying through Long Island Sound, and the Hudson River

steamers to Albany are among the most commodious of vessels for interior navigation. The coastwise trade must be carried on (according to law) in vessels built and owned in the United States.

In New York Harbor one also sees numbers of great ferry boats constantly passing between Jersey City and New York, or between New York and Brooklyn, Staten Island, and other neighboring points. To furnish docks and wharves and landing places for all these vessels, and for a great variety of smaller craft, such as canal boats, barges, tugs, excursion boats, dredge boats, and others, there must be miles of wharves along the water front. But there is room for all and to spare. There are twenty-five miles of possible wharfage along Manhattan Island, on the lower part of the North River (as the Hudson is called) and of the East River. The water front of Brooklyn and Jersey City furnishes additional miles of wharfage. Some of the great passenger steamship companies, like the North German Lloyd, have their wharves at Hoboken on the west bank of the Hudson.

As one sails up the Hudson, between Lower New York and Jersey City, one is astonished at the number and variety of large and small vessels passing up and down or back and forth across the river. Although the river is here a mile wide, the pilot of a big ferry boat must be constantly on the watch to find a clear passage and avoid collisions. In passing up the East River under the vast suspension bridges, one can see forests of masts of sailing vessels and steamers and the shore on both sides crowded with ships, loading and unloading. This is, perhaps, the best place in the world to see business and commerce on a

vast scale, the docks piled with immense quantities of goods, the holds of vessels noisy with the shouts of loading; and, on the land side, huge drays, stacked with goods and merchandise, crowding on to the piers. "Street railways run along the pier heads, and a continuous, crowded, and noisy procession of drays and carts pours up and down the streets or entangles itself in hopeless blocks," with a flood of shouts and profanity from the workmen and overseers.

"In going up the North River side from the Battery there is a continual succession of varied and busy scenes, the headquarters of the Coney Island steamboats; the huge piers of the Pennsylvania Railroad; the trim vessels of the New Orleans, Boston, and Savannah steamships; the huge white floating palaces of the Sound lines to Fall River and Providence and Norwich; the docks of the Hudson River lines; the Morgan and Old Dominion boats; and the resting-places of the unrivalled ocean greyhounds of the American, Guion, White Star, Cunard, and French lines. Along the East River a great space is given up to the large sailing ships, bringing in cargoes from all parts of the world, with their lofty masts and long yards interwoven against the sky. Then come the grain-laden canal boats from the West, hundreds of fruiters from the West Indies, and a line of ferries, above which appear several dry docks, followed by iron foundries, lumber yards, and old steamers laid up in ordinary. Almost every variety of vessel is found in these waters: the brilliant excursion steamboats, melodious with band music, and waving with flags and steamers; ark-like canal boats from the Great Lakes, distended with wheat and corn; the swift Norfolk schooners, redolent of fine

tobacco and of early vegetables; oyster boats from the Connecticut coast, small and pert in outlines and motion; huge full-rigged ships from Calcutta, laden with indigo; sooty steam barges from the Pennsylvania coal regions; Nova Scotia brigs, laden with fine potatoes; heavy old whalers, making port after long Arctic voyages; schooners from the West Indies and Honduras, crammed with tropical fruits; fishermen from the Grand Banks, heroes of the saltest Northern seas; Mediterranean merchantmen, with rich cargoes from the Levant; and hundreds of other types, each full of interest and attraction. The loom of the great environing cities, the breadth and life of the confluent waters, the intense and joyous activity of motion, combine to give this cosmopolitan picture an unusual breadth and life.

"Space fails to tell of the Barge Office at the Battery, and its customs inspectors and sailors' dispensary; of the natty flotilla of the Battery boatmen; of Ellis Island and its great buildings for the reception of immigrants; of the United States Navy Yard at Brooklyn, the chief naval station of the Republic; of the wonderful docks on the Brooklyn side, the home of a universal commerce; and of scores of other interesting scenes which surround the gateway of the New World." (King's "New York City.")

Besides its large Upper Bay and its unlimited water front for docks, the harbor of New York connects by the East River with Long Island Sound, offering a safe passage for large vessels sailing east along the New England coast. Formerly the reefs at Hell Gate were very dangerous for shipping. These rocks were tunnelled by engineers and

finally blown up in 1885, since which time the passage has been much safer. This was accomplished at an expense of millions of dollars.

The Hudson River, deep and broad, connects New York Harbor with the whole eastern part of New York State as far as Albany. From this point a canal connecting with Lake Champlain sends quantities of lumber into the Hudson and to New York, while all along the river vast brick yards and stone quarries send barge loads of building material to the docks of New York.

But the Erie Canal, connecting the Upper Hudson at Albany with Buffalo and the Great Lakes, has had the chief influence in increasing the commerce of New York City. The New York Central Railroad following the same line in later years has been far more important than the canal in the vast amount of freight carried to and from New York City.

There is also a third outlet to the ocean around Staten Island through shallow water for small vessels and barges of small draught.

In addition to the great and expensive improvement at Hell Gate, the government deepened and dredged the channels through the lower bay and opening to the ocean. Between Sandy Hook and Coney Island was a bar with shallows which it was difficult at low tide for large vessels to pass. By means of dredging boats the government scooped out a passage here 1000 feet wide and 30 feet deep at low tide. Since then the dredges have been at work producing another channel 2000 feet wide and 40 feet deep. These channels are protected by lighthouses and buoys, which guide ships into the harbor.

For the protection of the harbor and the great cities with their vast wealth in case of war, fortresses have been built at the commanding entrances: as Fort Wadsworth, on the sloping sides of the hill which rises just west of the Narrows. This, the heaviest defence, consists of a line of water batteries and heavy granite casemates on the hill-side. Opposite to it frown the walls of Fort Hamilton. Mortar batteries are placed on Sandy Hook and Long Island to command the Lower Bay. The East River is also protected by forts at its entrance from Long Island Sound. Bedloe's Island, upon which Bartholdi's Statue of Liberty stands, is a fortress with the gigantic statue rising from a pedestal in its centre. Governor's Island, near the lower end of New York, is the headquarters of the Eastern division of the United States army. It has sixty-five acres, covered with fine parade grounds, arsenals with great quantities of military supplies, the homes of the general and officers, and two fortresses, Fort Columbus and Fort Williams, which show the picturesque style of old fortifications.

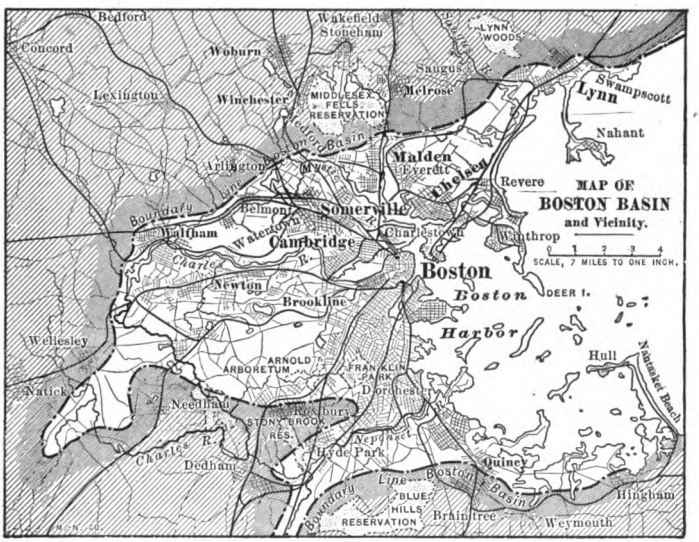
The use which New York makes of its superior harbor and other advantages can best be measured by the amount of exports sent out to other lands, and of imports from all parts of the world which pass through this gateway. In 1904 the value of imports received at New York was $600,171,033, of exports was $506,808,013, while the total value of exports for the United States was $1,591,825,873, and of imports was $1,117,215,160. This shows that over half of the imports and one-third of the exports of the United States pass through New York Harbor.

The duties imposed upon foreign goods and collected

at the harbor of New York make up a good share of the large income of the United States government. The custom house on Wall Street, New York, is the most important centre of the customs service of the United States, at whose head stands the Collector of the Port of New York, assisted by the naval officers and the Surveyor of the Port and the Appraisers. There are fifty steamship companies whose vessels bring dutiable goods from foreign countries and land them at the big warehouses located at the wharves on the East River, the North River, Jersey City, Hoboken, and Brooklyn. There are sixty-nine of these large warehouse and transportation companies for the receipt of goods. The custom house has in its employ seventeen hundred officers, whose duty is the inspection of foreign goods and the collection of duties for the government. The government also keeps in service twenty-nine vessels, called revenue cutters, four of them at the port of New York, whose duty it is to enforce the revenue laws, capture smugglers, and assist the Treasury Department in the collection of the revenue. There is, also, a division of the New York City police known as the "Steamboat Squad," which guards the harbor, docks, and boating from river thieves, smugglers, water rats, and fires.

There are several other great cities on the Atlantic coast — Boston, Philadelphia, Baltimore, and Savannah — which have good harbors and a large foreign trade. Boston harbor is roomy and well protected. Deep passages for ocean steamers have been dredged to East Boston and Charlestown Navy Yard. The entrance to Boston proper has a depth of twenty-seven feet. The commerce which

enters at Boston has given great value to dock locations. But its shipping is small compared with that of New York.



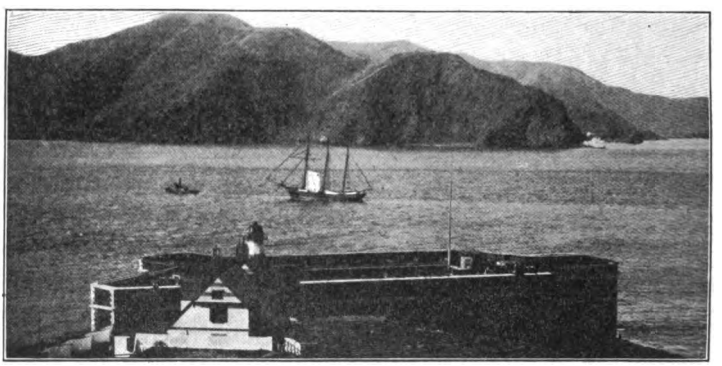
Map of Boston.

Philadelphia has very extensive docks along the Delaware River. The approaches to Philadelphia have been dredged out to secure entrance for ocean steamers, but the largest steamers find difficulty in ascending the Delaware to Philadelphia, and a project for deepening the river is now under consideration. Baltimore has a deep and commodious harbor on the west side of Chesapeake Bay.

Charleston Harbor in South Carolina has been given a deep passageway from the ocean by means of rock jetties and dredging between.

On the Mississippi River, New Orleans and St. Louis are supplied with abundant wharfage along the river banks. The outlet through the delta, once very shallow, was deepened to thirty feet by the Eads jetties.

The harbor of San Francisco compares best with that of New York in regard to depth, commodiousness, and



The Golden Gate, San Francisco.

general advantage of location for commerce. Like that of New York, the harbor of San Francisco has a deep entrance passage about a mile wide, known as the Golden Gate, the rocky, sloping sides of which are protected by forts like those at the Narrows. The Bay of San Francisco is immense in size, forty miles long and from five to eight miles wide, and is protected by low mountains, so that it is land-locked against sea and winds. On account of the rocky coast and the fogs which sometimes prevail, the San Francisco harbor is beset with some dangers. In many places the shores are gradually sloping shoals, but at the water front of San Francisco there is plenty of depth for

ocean-going vessels. The location of San Francisco in the centre of our Western coast, with every advantage for gathering the commerce of the Pacific, and on the east the Central Pacific, Southern Pacific, and other railroads to connect it with the Eastern states, gives San Francisco as great an advantage on the Pacific coast as New York on the Atlantic. The Puget Sound cities have also excellent harbors, but have not yet risen to the rank of great cities.

Chicago, the greatest of the lake ports, has managed by artificial means to produce a great harbor and shipping advantages. Originally Chicago River was a shallow, sluggish stream, but by dredging it out and by extending it with artificial canals, it has been made deep and extensive for the reception of lake steamers and sailing vessels. The outer harbor has been protected by a great breakwater, built out into the lake. The natural advantages of Chicago consisted, not so much in its harbor, as in its favorable position at the southwest end of Lake Michigan, — the nearest point at which railroads and canals could reach the Great Lakes from the most productive part of North America, *i.e.* from Illinois, Iowa, Missouri, Kansas, Nebraska, and other neighboring regions. There are several large cities on the Great Lakes with fine harbors and big commerce, such as Milwaukee, Detroit, Duluth, Cleveland, and Buffalo, but Chicago overshadows them all.

It is not difficult to see that New York on the Atlantic, Chicago on the Great Lakes, New Orleans on the Lower Mississippi and Gulf, and San Francisco on the Pacific hold the commanding positions in the commerce of the United States.

Rapid Transit

2. Manhattan Island, although about thirteen miles long and nearly two miles wide, is not nearly large enough for all the people who would like to live and do business there. Hundreds of thousands of people, who are in business in New York in the daytime, live elsewhere,— in Brooklyn, Jersey City, the Bronx, Yonkers, or in other suburbs from ten to twenty miles away. Even the people who live in the north half of Manhattan Island must have some quick means of reaching their places of business in the lower part of the city five or ten miles away. In the earlier rush hours of the morning, from seven to nine o'clock, and from five to seven in the evening, when people are coming to and going from offices and stores, the street cars, elevated trains, and ferries across the rivers are crowded with passengers. Oftentimes the aisles and platforms of cars are jammed with people, and there is a crush to find standing room. The rapid growth in population in the last fifty years has made it difficult to keep up a sufficient means of rapid transit to accommodate the people.

The population in 1850 was 515,000; in 1860, 813,000; in 1870, 942,000; in 1880, 1,206,000; in 1890, 1,515,000; in 1900, Greater New York contained 3,595,000 people, and in 1905, 4,000,000.

In the last ten years the growth has been more rapid in cities surrounding Manhattan Island, such as Brooklyn, Jersey City, Newark, the Bronx, and the number of people who crowd into New York daily from these and other surrounding cities has increased the difficulties of rapid transit.

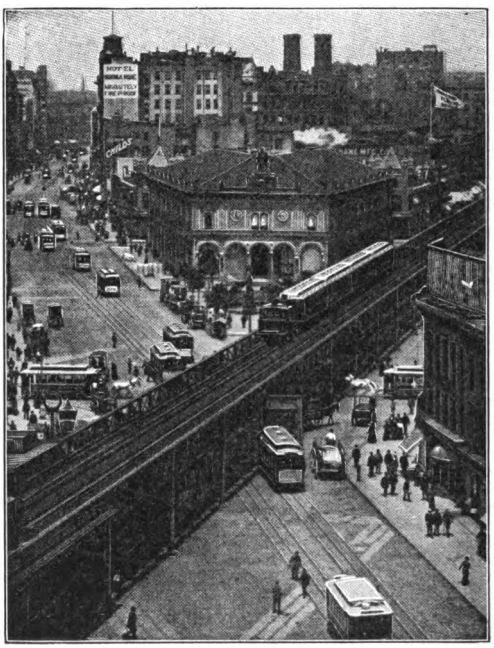
New York has a variety of modes of transporting

people to the suburbs, by regular railways, by steamboat — ferries connecting with the railways in Jersey City and Brooklyn, — by surface cars, by elevated railways, and by subways. In olden times, before street cars came into use, omnibuses and carriages and boats were the chief means of transit. Broadway was crowded with great lumbering omnibuses which followed the old Boston road northward. These were crowded out by the more convenient horse cars. New York was the first city in the world to use horse cars instead of omnibuses.

Of late years every possible means has been resorted to in order to secure quick and regular transport of passengers to and from the city. The surface street-car lines form a complete network, covering the streets in all directions. A few years ago they had 5000 cars and carried, on the average, about 1,300,000 passengers a day. "The various surface lines running north and south carry, between the hours of seven and nine, 100,000 in one direction, south, and between the hours of five and six carry the same 100,000 back to their homes. It is estimated that 76,000 persons travel on these same surface roads from their homes to places of amusement every evening in the year, and back again after the performances are over." ("The New York Subway Souvenir.") Cable cars and trolley lines have displaced the horse cars, and for short distances in many parts of the city these surface cars are the only available means of transit. Their capital stock was estimated at $95,000,000.

To relieve the pressure of passenger transport between the up and down town districts of New York, the elevated railways were put in operation in 1878. These roads are

built on iron posts and girders along the main north and south avenues, and run on a level with the second or third story windows of houses. A few years ago it was said, "The elevated railroad is the crowning achievement in



An Elevated Railroad in New York City.

solving the problems of rapid transit. By its aid the New Yorkers fly through the air, from end to end of their teeming island, at railway speed, and in comfortable, well-appointed cars." The stations are about one-third of a mile apart, and during the busy hours of the day trains

pass about once a minute. The New York Elevated cost originally $20,500,000, the Metropolitan Elevated cost $23,300,000.

The Manhattan Company in 1879 bought up both of these companies and has since extended their lines. It has some 400 locomotives and 1600 cars, and carries about 250,000,000 passengers annually, or nearly 700,000 a day. The elevated roads of New York City are now capitalized at $120,000,000, which is much in excess of their actual cost.

A few years ago it became evident that both the surface cars and the great system of elevated trains together could not handle comfortably the vast throng of passengers during the busy hours, morning and evening. In 1888 Abram S. Hewitt, Mayor of New York, outlined a plan for the construction of an underground road extending the length of Manhattan Island. Such a road would have to be built under Broadway and other streets through the heart of the city, and in the middle and upper parts of the island through solid rock. While building, it must not obstruct traffic in Broadway and other streets, and it must make proper provision for sewer pipes, water mains, and other underground works in the streets. Mayor Hewitt said in his statement: "It is evident that underground rapid transit cannot be secured by the investment of private capital, but in some way or other its construction must be dependent upon the use of the credit of the city of New York. It is also apparent that if such credit be used, the property must belong to the city. But inasmuch as it would not be safe for the city to undertake the construction itself, the intervention of a contracting party appears to be indispensable."

In other words, the city and some private company must coöperate in the construction of this great work.

It required several years of discouraging efforts in the state legislature at Albany, with the city council of New York, and with the supreme court of the state, and finally two popular elections by the voters of the city, before this great scheme could be brought into shape for execution.

Finally Mr. August Belmont, a rich financier of New York, agreed to head a company with a capital of $6,000,000 to finance the scheme, and this company made a contract with Mr. John McDonald, an eminent engineer and contractor, to construct the road for $35,000,000. "By the terms of the contract the road was to be leased by the city to Mr. McDonald for fifty years, and required in return a rental equal to the interest payable by the city upon the bonds issued by it to provide means of construction, and also to pay one per cent on the whole amount of the bonds issued for its protection." This one per cent extra, paid in each year, goes to the establishment of a sinking fund which, put at interest, by the end of the fifty year franchise period will amount to $35,000,000, sufficient to pay off the city bonds for the subway. Thus at the end of fifty years the whole subway is to become the property of the city. The city in the meantime has not taxed itself in any way to build the road or to pay off the bonds.

In 1900 Mayor Van Wyck turned the first spadeful of earth in the construction of this road. For four years ten thousand men were employed much of the time in the work of excavating and building. The tunnel is twenty-one miles in length. "In the construction of the subway of New York it has been necessary to cut away nearly a

million cubic yards of rock by tunnelling. In the construction of this new highway there have been used over seventy-one thousand tons of steel, and nearly ten thousand tons of cast iron; over half a million yards of concrete, and nearly a million square yards of waterproofing."

The whole cost to the city is about $40,000,000, and Mr. McDonald and his company spent about $20,000,000 additional in equipment with engines, cars, etc.

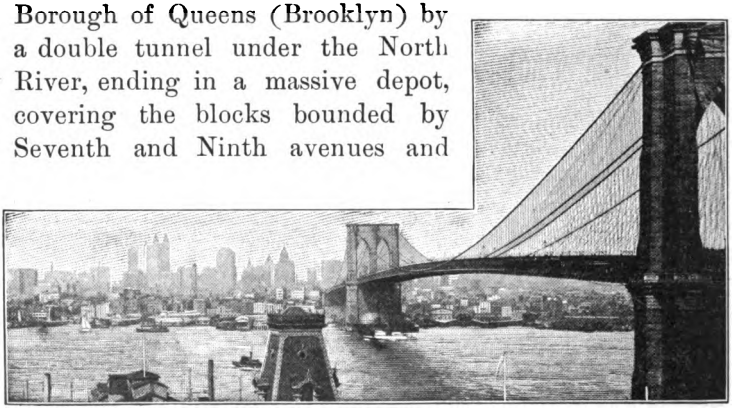
From this estimate it is evident that the subway of New York, twenty-one miles long, cost about as much, including the equipment, as the first construction of the Union Pacific Railway from Council Bluffs to Ogden, Utah, a distance of 1042 miles.

"The subway must be dry, others have been known to leak. . . . The New York subway has been built with top, sides, and bottom of concrete and waterproofing in alternate layers, incasing a framework of steel beams. The roof is supported by steel pillars five feet apart, and set in parallel rows in concrete top and bottom.

"The results of the subway enterprise show that the plans have been completely successful. Express trains making thirty miles an hour run on the subway tracks between 145th Street (at the north end of Manhattan) and City Hall, stopping at stations a little over a mile apart. The local trains, which make about fifteen miles an hour, stop every few blocks. Electric cars in trains, running on the third-rail system, are used in the tunnel."

The stations are commodious and built with artistic design and decoration. The first day of the opening of the subway several hundred thousand passengers were carried without difficulty.

In spite of the immense cost and successful operation of the elevated railways and of the subway, the busy hours still witness a severe crowding of the passengers on all the trains. The success of the subway has, accordingly, only stimulated enterprises for a greater extension of the subway system. Plans have been discussed which will involve the expenditure of $250,000,000 in New York subways. "As now planned the subway will connect with a tunnel passing under the East River to Brooklyn . . . making provision for rapid transit to the Borough of Brooklyn by numerous arteries of the original subway system, all connected with the original plant devised solely for the Boroughs of Manhattan and the Bronx. However, the board has granted a franchise for a tunnel system, passing from Weehawken in New Jersey, across the North River under Manhattan Island to the Borough of Queens (Brooklyn) by a double tunnel under the North River, ending in a massive depot, covering the blocks bounded by Seventh and Ninth avenues and



Brooklyn Bridge.

31st and 33d streets. From this underground station, three tunnels are to extend under the East River into

the Borough of Queens, giving the Pennsylvania Railroad Company direct communication, not only with Manhattan Island, but with the extremities of Long Island." (The New York Subway Souvenir.)

The Brooklyn Bridge was also built to satisfy the great demand for transportation between Brooklyn and New York. Scores of big ferry boats still ply between these cities, but the big suspension bridge provides passage for 150,000 persons each day. Two trolley cars pass over the bridge each minute, and there are roads for vehicles and foot paths for pedestrians. The main span of this bridge between the two towers is 1595 feet, and it is 135 feet above high water. Mr. Washington Roebling, after the death of his father in 1869, undertook the direction of the work and carried it on for thirteen years against great difficulties. It was completed and opened to the public in 1884 at a cost of about $15,000,000. The Williamsburg Bridge was opened in 1903, and two more bridges are being constructed.

The regular steam railroads, like the New York Central and Hudson River, the Pennsylvania, and other lines on the Jersey shore, carry about 500,000 passengers daily to or from the city. About 1000 passenger trains leave the city daily on these various steam railroads. Including the passengers of the elevated and surface lines, the total daily movement of passengers on all the roads of the city is 2,500,000 people.

In spite of the enormous expense of these various means of rapid transit, the present facilities are overcrowded, and as the city continues to grow, it must provide larger opportunities of entrance to and escape from the city.

The fact that New York City is upon an island, completely surrounded by broad and deep rivers, has made the problem of rapid transit unusually difficult. So long as the city was of reasonable size, no serious inconvenience was felt; but when the population rose into the millions, and from all directions beyond Manhattan hundreds of thousands of people daily, at certain hours, poured into the central city, rapid transit became a question of magnitude. The result is that no city in the world has lavished so many millions upon projects for providing rapid transit.

Other large cities of the United States have been compelled to adopt similar plans for transport. Boston was the first city in the United States to build a subway. An examination of the local map of Boston will show that the central city is placed on a peninsula, mainly surrounded by water, and connected only by a narrow neck of land with the mainland. Boston also has a great number of surrounding suburbs which pour their populations of business people daily into the central business section. It requires, therefore, all possible means of rapid transit, such as steam railroads, elevated railways, surface cars, subways, and ferries.

Chicago has begun to struggle mightily with the problem of rapid transit. Besides its surface cars in all directions, it has a remarkable system of elevated roads centring in a great loop in the down-town business district, upon which all incoming trains must make the circuit before passing out again to the suburbs. But on account of the congestion of passenger traffic in the rush hours, Chicago has begun to consider seriously a large system of subways

similar to those of New York. Among other peculiarities, Chicago has several tunnels through which street cars pass under Chicago River to the north and west. Chicago has also a system of private tunnels for freight cars supplying large establishments with goods by underground passages.

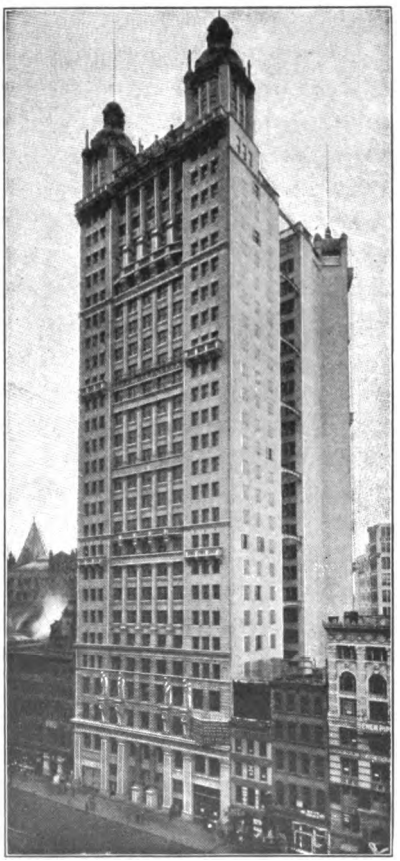
Philadelphia as yet has adopted neither elevated roads nor subways excepting the subway recently finished by the Pennsylvania Road, but the ease with which it can dismiss its people over the main suburban railroads and electric car lines in all directions has prevented the congestion of passenger transport as in the cities previously mentioned. In Baltimore, New Orleans, San Francisco, and all other large cities, everywhere, we find this same problem of rapid transit, and in each case it must be solved according to local needs.

Most of the well-to-do and educated classes of people in our large cities much prefer to live away from the smoke and noise of the city, in beautiful suburbs, where they can have room for large yards, with flowers, trees, and playgrounds for children. The crowded thoroughfares of a great city are no suitable places for families, especially those with children. Thousands of families live on Manhattan Island, but in most cases there are no playgrounds except the crowded streets, and they furnish no proper surroundings for children to play in.

Even in our lesser cities and towns the use of street cars and other modes of rapid transit is becoming common, and enable many people to live farther from the town and more in the roomy, open country.

Population of Manhattan Island

3. While the whole region of country for twenty miles about the centre of New York is in the main thickly populated, so that it contains far more people than the thirteen colonies at the time of the Revolution, in the lower part of Manhattan Island they are like bees in a beehive, and it is difficult to see how they avoid stepping upon each other. In a few spots, it is said, in the tenement district, there are a thousand people to the acre. In the great office buildings along lower Broadway, thousands of people are found during business hours in a single building.



The Park Row Building.

One of the earlier of these great office buildings, completed in 1884, stands on a lot about 85 by 200 feet, and is 12 stories high. The tenants and other employees in the building number about 1500. But this is

a small building compared with some of the more recent "skyscrapers," 27 stories high.

On account of the crowded condition of the city and the extravagant price of city lots for houses, many people who can afford it live with their families in hotels or apartment houses. From 23d Street north for two miles there is a great number of magnificent hotels. Some of these great buildings, like the Waldorf Astoria on Fifth Avenue, the Savoy, and the New Netherland, are palaces, costing many millions of dollars; their parlors and dining rooms are modelled after the royal palaces of Europe. The halls and passages are lined with marbles and beautiful stones, and the finest of carved woods; there are hundreds of elegant bath rooms in connection with sumptuous private apartments. Many wealthy families prefer to live in these hotels to avoid the trouble and perhaps even greater expense of housekeeping.

Some of the apartment buildings with suites of apartments for private families are on a grand scale, from a dozen to fifteen stories high, and extravagant in their architecture and interior decorations. Most of the great apartment houses are in the neighborhood of Central Park. One of the larger of these older apartment houses is a group of such buildings on 59th Street, known as the Central Park or Navarro Flats. "Architecturally they are notable, with Moorish arches, numerous balconies, grand entrances, and highly ornamented façades in the Spanish style. In interior appointments the houses are not surpassed in the world. The structure cost $7,000,000."

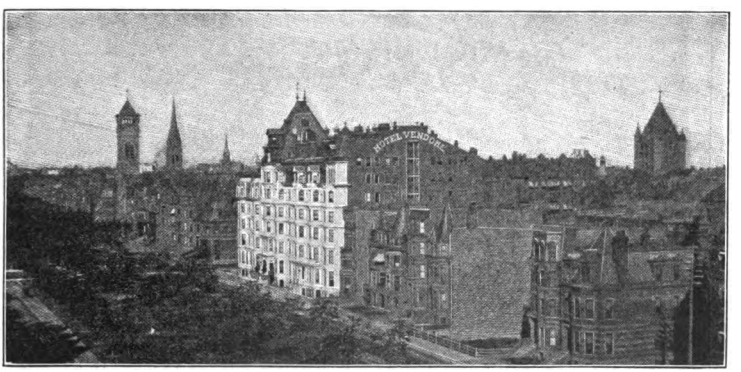
There are scores of these vast apartment houses of varying styles and expense. Then there is a countless number of

flat buildings for the accommodation of families, with four to ten room flats, including living rooms, dining rooms and kitchen. "They have generally five or six small rooms, with private hall, bath room, kitchen, range, freight elevator for groceries, etc., janitor's service, gas chandeliers, very fair woodwork and wall paper, and often steam heat. Between $25 and $50 a month rental."

Besides lodging and boarding houses "the tenements display the lowly side and often the dark side of New York life. Tenement houses are, as a rule, great towering buildings, many of them squalid and in bad repair, and devoid of any but the rudest arrangements for existence. They are packed with human beings. In a single block between Avenue B and Avenue C, and 2d and 3d streets, there are over 3500 residents, and a smaller block at Houston Street contains 3000 people, which is at a rate of 1,000,000 to the square mile. That section is altogether populated at the rate of 500,000 to the square mile, which is as if the whole population of the city should be crowded into a space less than two miles square (*i.e.* of Manhattan).

"The picture of life in these quarters repeats what has been so often written of the misery of the poor in great cities. Frequently half a dozen people eat, sleep, and somehow exist in a single room, and tenants who have two or three rooms generally keep boarders besides their own large families. Monthly rents range from $1 a room upward, and $10 will sometimes secure a small stuffy apartment of three or four rooms. The landlords of these rookeries become very rich out of the needs of the poor tenants. Most of the old tenement houses are occupied by immigrants just from Europe." (King's "New York City," p. 244.)

It is difficult for those of us who live in comfortable homes to imagine the misery of women and children in these dirty and comfortless homes, with little heat or warm clothing in the bitter cold of winter. They are also a prey to disease on account of bad air, and leaky sewers and pipes, and other unsanitary surroundings. These are well known in New York City as the *slum* districts. Jacob Riis in his book "The Battle with the Slum" has given vivid descriptions of the misery and crime in these poor quarters, and of the efforts of philanthropists to improve these conditions.



Commonwealth Avenue, Boston. Houses of the Wealthy.

Not far away, sometimes scarcely a stone's throw, are the homes of abounding wealth. On Fifth Avenue, about Washington Square and above, are the palatial homes of some of the wealthiest Americans. "Fifth Avenue is celebrated the world over as the grand residence of the aristocratic and wealthy families of the metropolis. In recent years grand residences of prominent people have

arisen on many of the cross streets immediately out of the avenue, and in other favored localities. From Washington Square for a distance of nearly four miles, Fifth Avenue is lined with handsome residences, club houses, churches, and hotels that give abundant evidence of wealth and luxurious tastes." The lower part of the avenue has been largely

Vanderbilt House.

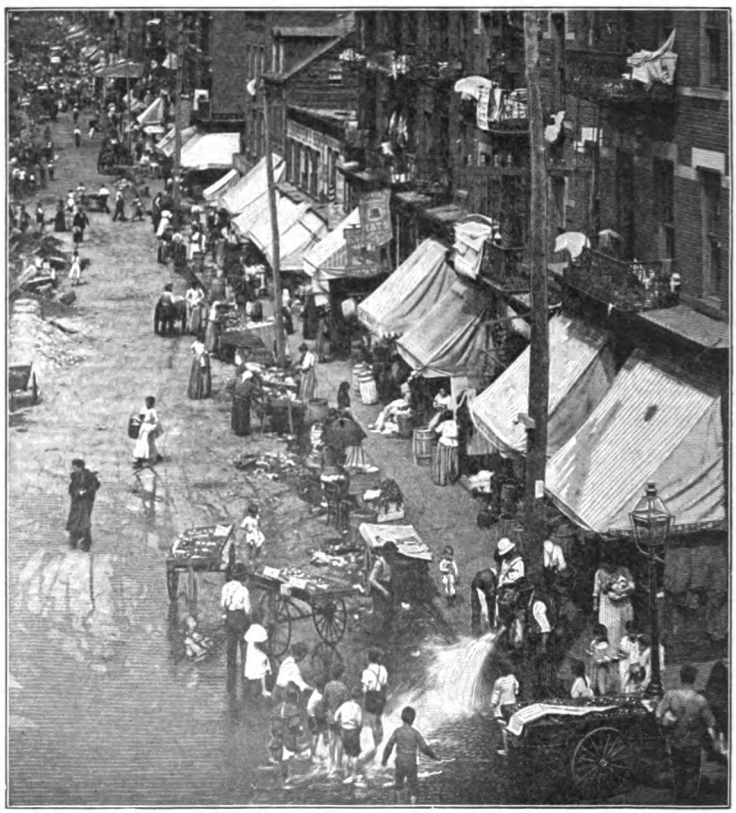
occupied with business houses, especially by the great publishing firms. A ride up Fifth Avenue on the top of a modern omnibus is one of the interesting excursions often indulged in by sight-seers. One need not go far in New York to see both the homes of boundless wealth and the miserable dens of the poorest of the poor.

Immigration

Many of the poor in the crowded districts are recently arrived immigrants of the poorer classes. New York has always been the chief centre toward which immigrants from foreign countries, especially from Europe, flock to America. The following table gives the number of immigrants in the last ten years: 1896, 343,000; 1897, 230,000; 1898, 229,000; 1899, 311,000; 1900, 448,000; 1901, 487,000; 1902, 648,000; 1903, 857,000; 1904, 812,000. Of this whole number in 1904, 606,000 came through the port of New York. During the year closing June 30, 1906, 1,100,735 immigrants came to the United States, besides 65,618 non-immigrant aliens.

On Ellis Island, in the upper harbor of New York, the United States government has buildings where immigrants are landed and inspected. There are laws regulating the admission of immigrants and excluding certain classes of persons such as paupers, imbeciles, criminals, and those infected with contagious or dangerous diseases. These are refused admission and returned to the countries from which they came.

During the last summer as many as twelve thousand immigrants have been landed in New York in a single day, enough to make a small city. The great Atlantic steamers are loaded with these steerage passengers. Sometimes a single vessel has twelve or fifteen hundred passengers. The great majority of them cannot speak English, and are almost helpless on first landing. But there are government as well as private agencies which give advice and direction to the immigrants, and assist them in finding



East Side, New York.

homes and employment. In the last few years there has been a great increase in the poorer class of immigrants from Italy, Hungary, and Russia, especially Russian Jews.

There are certain sections of New York City, on the

lower east side of Manhattan, known as the tenement-house district, where these foreigners have become established in large numbers, so as to form an Italian quarter, a Jewish quarter, and other distinct national groups. They herd together in the poorest tenement houses, and are constantly recruited from the newly arrived immigrants. They speak no English and know nothing of American ideas or customs. They constitute the natural breeding places of immorality, disease, and crime. As soon as the lower class of politicians can get hold of them, they become naturalized citizens and voters, and help to settle all important questions on election day.

The children who come into the public schools in these quarters of the city cannot speak English. Whole roomfuls know scarcely a word of English, and the teachers have a long task in getting them started toward American education and citizenship.

"Greater New York City is the most cosmopolitan city in the world. Within her borders are representatives of almost every nation and city upon the earth. Her foreign born number 1,250,000, and their children swell the number to 2,500,000, or nearly two-thirds of the city's entire population. At the head of the list stand the Germans, who number nearly 900,000. Next come the Irish, mustering 850,000. There are 170,000 English, 105,000 Russians, 100,000 Italians, and 50,000 Scotch. America's metropolis is the largest Irish city in the world. Dublin, the chief city of the Emerald Isle, has less than half as many. Next to Berlin she is also the world's largest German city. She has nearly as many Germans as Hamburg and Munich combined." (G. B. Waldren, in *McClure's*, Vol. 9.)

Other cities in the United States have also very large foreign populations. Cincinnati, Milwaukee, St. Louis, and

Tenement District, Boston.

Chicago have immense German populations, and large sections of these cities are almost wholly German. New Orleans has a large Italian population. San Francisco has its Chinese quarter. Minneapolis and St. Paul abound in Norwegians and Swedes, while the Mexicans constitute a considerable portion of San Antonio and Santa Fé.

Charities

All great cities are supplied with a large class of poor people, but in New York the number of persons in the pauper and dependent class is greater in proportion to population than in other large cities. This is partly due

to immigration, and partly, perhaps, to the good treatment accorded to the dependent classes in New York. There is a large number of charitable organizations, both public and private, for the relief of the needy. The government of New York City spends yearly about $2,000,000 in direct help to the needy and sick. Besides this, the city assists a large number of private charitable organizations, church societies, orphanages, hospitals, missions, etc., to the extent of $5,000,000 a year. The city, therefore, actually spends about $7,000,000 a year, directly and indirectly, in all forms of charitable work. In addition to what the city does, private charitable societies contribute much also. Bird S. Coler, an eminent authority, says: "The abuse of public charity has grown to such proportions that the city has become the Mecca of the chronic idlers and tramps of the entire country. It is easier for an industrious and shrewd professional beggar to live in luxury in New York City than to exist in any other city in the world." King enumerates the charitable societies in New York as follows: "Public charities, 28; for temporary relief, 83; for special relief, 51; for foreigners' relief, 26; for permanent relief, 67; for medical relief, 101; for defectives, 16; reformatory, 16; miscellaneous, 232, making a grand total of nearly 700 charitable and benevolent institutions." This report refers to the part of New York on Manhattan Island.

Of course there is pressing necessity for a great amount of real charity in New York City, but it is very difficult to get the aid to those who most need it, *i.e.* to the deserving poor, and at the same time to avoid giving to professional beggars and impostors. There are a great many

societies which provide for orphan or neglected children. Mr. Bird Coler says: "The care of dependent children is, in its relations to the interests of the state, the most important governmental problem involved in the field of charitable activity. . . . In the city of New York, 50,638 children in private institutions are cared for at the public expense. This is one to sixty-eight of the estimated population of the city." Many of these children have parents, but the parents are so poor or so worthless that the children are taken in charge and cared for in orphanages at public expense. It is a sad thing to think of these thousands of children without homes, even though they are cared for in public institutions.

In New York there are great hospitals for the care of sick and injured people. Many of these are first-class pay hospitals, others are parts of medical schools, others are charitable establishments for the relief of the poor. The city also supports a number of almshouses, workhouses, and jails for the care and correction of criminals. "In 1901 the city maintained three almshouses with 3646 inmates, and eleven hospitals (two of which are asylums for idiots) with 53,991 patients. Nearly all the city institutions and some of the state and private institutions are located on Randalls, Wards, and Blackwells islands in the East River." ("International Cyclopædia.")

It is evident from the above that New York City has a heavy load in taking care of its poor and dependent classes, its sick people and imbeciles, the foreign population in the slums, and the criminals who abound in such a great city.

Other cities, as Boston, Baltimore, Chicago, New Orleans,

Pittsburg, and San Francisco, have their slum districts, their thousands of poor and helpless, and their various city and charitable organizations for providing help against sickness, poverty, and crime.

The Government

4. The chief officer at the head of the government of the city is the Mayor, who is elected every two years, and receives a salary of $15,000 per year. He is invested with much power in the appointment of the heads of departments under him, as of Public Works, of Parks, of Police, of Health, of Law, of Fire, of Taxes and Assessments, of Charities, of Education, and of several others. A board of aldermen of seventy-three members forms a city council for the enactment of laws for the municipality. The great responsibilities exercised by the city government are seen in the fact that it controls the street department, the fire and water departments, the public schools, the police, the public charities, the granting of public franchises, and other important city concerns.

The election of a mayor and other city officers every two years in New York is an important public event, because often the reform of great abuses is attempted, and large public improvements are at stake. In a big city like New York, where there are so many ignorant voters, and where the saloon and other bad influences are so powerful, where even the police sometimes are said to work in sympathy with the law breakers and criminals, it is very difficult to secure good government. It has been almost impossible at times to get the streets properly cleaned, to secure an abundance of pure water for the city, to control mobs, to

build sufficient schoolhouses for all school children, to capture and punish criminals, and to overcome corruption and dishonesty in the government itself. It has been often said that the government of large cities like New York is the most disgraceful part of American politics.

When we call to mind the hundreds of churches and educational institutions in the city, the large number of wealthy and intelligent people, the numerous great newspapers and monthly periodicals published and circulated in New York, we might think it an easy undertaking to secure wise and good government. As a matter of fact, many millions of dollars of public money have been squandered by the corrupt political gangs that have gained control of the New York City government from time to time, and it takes constant vigilance and energetic effort on the part of the better classes of the people to maintain a moderate degree of decency in the city, and to keep the corrupt and criminal politicians from controlling the city government for their own selfish advantage. It is fortunate for New York that there have been many strong, patriotic men who have fought with boldness and persistence against these enemies of society. At all times New York has had such brave leaders, as Colonel Waring, Mr. Jerome, Mr. Roosevelt, Mayor Hewett, George William Curtis, and others. Governor Folk said lately in a public speech in Philadelphia, "There is more aggressive rottenness and less aggressive patriotism in our large cities than anywhere else."

Perhaps the chief reason why the politics of New York City is often corrupt is that those who govern the city have the management and disposal of immense sums of money

obtained yearly from taxes, licenses on saloons and docks, and from various city franchises. When bad politicians get into leading offices they can handle the city's business, — contracts for street cleaning, building, and expenditures for police, water, gas, and other purposes — so as to make large private fortunes for themselves. The budget or list of expenses for New York City is three times that of any other city in America, and is greater than that of any other city in the world. It is a very wealthy city. The income for New York City in 1901 was $118,740,596. Some of the items of expense were as follows: Schools, $19,731,000, the largest single item; interest on the public debt, $13,693,000; police department, $10,199,000; fire department, $4,739,000; water works, $3,000,000.

The debt of the city was $426,174,000, the sinking fund $121,340,000.

One great source of danger and corruption in New York City has been the granting of franchises to railroads, street-car companies, gas companies, and other public service corporations. Some of these great franchises are extremely profitable, and large corporations have sometimes been willing to pay a good price to aldermen and other city officials to secure such franchises for a long period. Corrupt aldermen and city officials have sometimes had no other ambition than to sell their influence for as high a price as possible. The result is that some of the most valuable franchises worth millions of dollars to the people have been sold out and lost. In recent years the people have come to understand better the increasing value of these vast franchises, and have begun to require a much larger profit to the city, and after a

fixed period of time the return of street-car lines and other public improvements to the full ownership by the city. The subway is an illustration of this, and after fifty years it will become the property of the city, and that without cost to the city. Under a wise system of government the income to the city from these franchises will pay a large part of the expense of government, and thus reduce greatly the taxes imposed upon the people.

Other great cities, like Philadelphia, Chicago, New Orleans, Baltimore, and San Francisco, have had a similar experience in their city governments in trying to preserve the rights of the people, and in overcoming the corruption of politics which has often bartered away for a small price, or for no price at all, the most profitable privileges and franchises. Philadelphia and Chicago have been especially distinguished for their corrupt political gangs. Cities of the second rank also, like Cincinnati, Minneapolis, and Buffalo, have had the same dangers to face, with about the same results.

The Water Supply

5. One of the most important things in the management of a city is the provision for a pure and abundant supply of water. The city of New York, apart from Brooklyn, owns a very extensive water system which has cost about forty millions of dollars. Originally the people of New York supplied themselves from springs and wells. But wells and springs in thickly populated regions are sure to become contaminated, and are very dangerous to health. Moreover, a much larger quantity of water was required

than could be obtained from ordinary wells. Even before the Revolution a reservoir was built and the water carried to houses through wooden pipes. The present water system was inaugurated in 1835 by building the first Croton aqueduct, which reached from Croton Lake, 30 miles north of New York, to Central Park Reservoir. Croton Lake is fed by Croton River and other smaller streams, and this was formed into a reservoir 5 miles long by erecting a dam which raised the water 40 feet. A brick tunnel or conduit 8½ feet by 7½ feet (partly also of stone and cement), and passing through 16 tunnels and under 25 streams, finally crossed the Harlem River upon High Bridge and connected with the high-service reservoir. Thence it was conducted to the Central Park Reservoir. This system of waterworks, including the aqueduct and reservoir, was completed in 1842. But by 1880 the needs of the city had outgrown this system, which was forced to supply 100,000,000 gallons a day, although originally designed to supply but 60,000,000 gallons.

In 1883 plans were completed for the construction of a new and larger aqueduct about 13½ feet in diameter. It is really a tunnel about 30 miles long, having 38 shafts from 28 to 350 feet deep, some of them being open so as to allow repairs. "The average depth of the tunnel beneath the ground is 170 feet, but in South Yonkers it was built in an open trench for the distance of half a mile, and also at the Pocantico River and Ardsley it comes to the surface. At each of these three places there are blow-outs and waste weirs by which the flow of water can be turned off at any time for the purpose of making repairs and cleansing the aqueduct. . . . At the Harlem River there is a fine

piece of engineering in the inverted siphon by which the water is carried under the river to the High Bridge Station. . . . The cost of this tunnel, exclusive of lands, engineering, superintendence, etc., was $19,612,000." (King, "New York City.") Its capacity is 300,000,000 gallons a day.

A new Croton dam has also been built fifteen hundred feet long to enlarge the Croton Lake and Reservoir. The water supply of the Croton River and watershed is believed to be pure and abundant so that the city may be furnished with healthful water. This is one of the chief means of preserving the health of millions of people in New York City.

In the city are also hundreds of large manufacturing plants which require abundant supplies of water, as well as hotels, public buildings, etc. The public hydrants on the streets are connected with the water mains, and the whole city water supply can be made available for combating fires which break out in the city.

The expense of supplying the city with water is met by charging every householder and business place using water with a regular water rent. In this way sufficient revenue is collected to pay the expense of conducting it, the interest on the bonds, and to establish a sinking fund which will eventually pay off the bonds for waterworks. Thus the water supply does not become a direct tax burden upon the city.

The sewer system of the city, reaching to all streets and houses, carries off the waste water and other refuse to the East and North rivers. The sewer system of a great city like New York is also a large source of expense, as

sewer mains and pipes must be laid deep in all the main streets. One great advantage of New York City is the fact that the tide sweeps down the rivers daily through the bay, and carries the waste of the city into the ocean. The salt tides of the ocean, sweeping past Manhattan Island, are a great natural house-cleaning device, better than anything that man could invent. Brooklyn is furnished with a system of waterworks and reservoirs of its own, while the Bronx is supplied from the Croton system.

Other great cities have been compelled to establish means of water supply more or less similar to those of New York. Chicago has a unique method of drawing its water supply from Lake Michigan. First a great tunnel was extended two miles under the bed of the lake away from the city, and connecting with a barrel-shaped crib, reaching from the surface to the bottom of the lake. From this intake crib the water is conducted through the tunnel to the city, and distributed by water mains through all the streets. With the increase of the city, a second tunnel was dug, extending four miles under the lake and terminating likewise in an intake crib.

It was found, however, that the sewage of the city, flowing from the Chicago River into the lake, contaminated the waters out as far as the cribs. On this account the big drainage canal was built to turn the waters of Chicago River and carry the entire sewage of the city down the Illinois, thus leaving the lake water clean for the use of Chicago. This drainage canal was two hundred feet wide and thirty feet deep, cut much of the way through solid limestone, and has cost the city about $36,000,000.

St. Louis and other cities objected to the contamination

of the Illinois and Mississippi rivers by Chicago sewage, and brought suit against Chicago in the Federal Courts to restrain her in this plan of sewage disposal. But the decision of the Courts was favorable to Chicago.

St. Louis, like many other cities, draws her water supply from the Mississippi River. Having pumped the river water into large reservoirs, she then distributes it by mains over the city. Cincinnati and Pittsburg in a similar manner draw their water supply from the rivers.

Boston, like New York, obtains its water supply from a small river in an upland hilly region, where huge reservoirs have been made by dams in streams, and an aqueduct carries the water many miles to the city. Washington obtains its water from the Potomac above the city, and pumps it into immense filters covering thirty acres of land, and from these it is collected and distributed by mains over the city. Previous to the construction of this filter system the water-supply of Washington was regarded as very unhealthful.

Even small cities and towns are compelled to sink deep wells, or establish filtering plants and a water system in order to obtain a sufficient supply of pure water. Every one now recognizes the absolute necessity of good and abundant water for the health and convenience of the people.

The Board of Health

6. This important department of the city government is under obligation to examine carefully and constantly all public and private houses, factories, schools, markets,

streets, and other places wherever anything threatens the public health, and also to use whatever means are necessary to put a stop to these dangers. Every owner is expected to keep his house and premises in good sanitary condition, and if not, to be compelled to do so by the health officers. The board of health has a large number of physicians on its staff who look after the many phases of sanitation in the city. All cases of contagious and infectious diseases are looked after, quarantined, or removed to hospitals where necessary.

The street-cleaning department with 1500 men and 500 carts, in Manhattan Island, try to keep the streets free from rubbish and dirt. Sometimes they have not succeeded very well, and there have been some interesting episodes in the history of New York, where they made a special effort to clean up the streets.

The board of health gives much attention to the inspection of tenement houses in the poor quarters of the city, and by constant vigilance has much improved the health conditions in these dark and dismal places. Under the tenement-house laws passed during the administration of Governor Roosevelt the conditions are thought to be much improved.

In recent years the board of health, through its inspectors, has done much to improve the quality of foods sold in the city, especially meats and milk. It was found that the great mortality among infant children during the hot summer months was owing partly to the bad milk peddled out to the poor. This led to a study of the milk problem, and finally inspectors were sent out to the many dairies in the neighboring counties which ship milk into New York

City. The dairymen, before their milk could be certified to, were required to put their stables and milking arrangements upon a good sanitary basis, and to furnish milk of standard quality and richness. The result has been a general improvement in the quality of milk, and in the health of those who use it. The death rate among children was thus decreased.

The inspectors also have the supervision of the markets and stores where foods are sold. There are certain laws against food adulteration, as of fruits, butter, coffee, canned fruits, alcoholic drinks, and other products. Our last National Congress passed an important pure food bill for the protection of the people against food adulteration.

The inspection of factories and workshops is designed to see whether the laws in regard to ventilation, cleanliness, danger from accidents, and various sanitary requirements are fulfilled.

The powers and duties of the board of health are defined in the sanitary code which consists of two hundred and nineteen sections, and is made up of the sanitary ordinances adopted by the department of health.

In all cities these regulations in regard to sanitation are of profound importance, and as the people become better educated, they will pay closer heed to them.

Public Parks

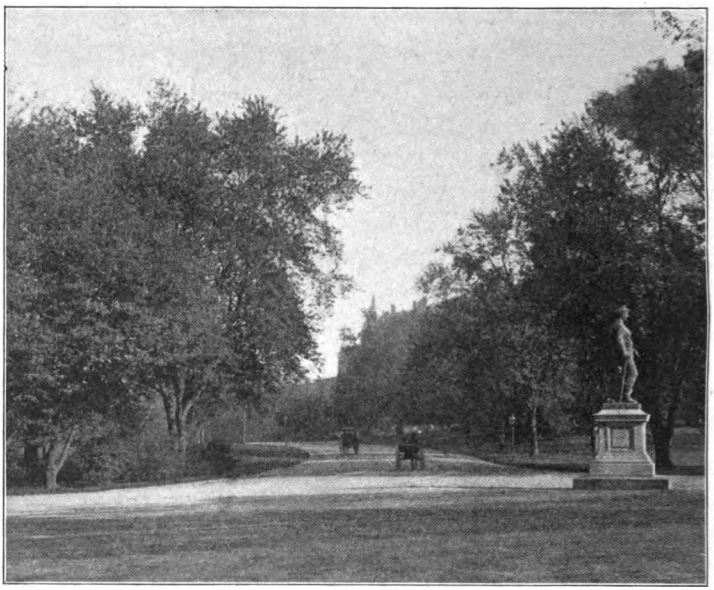
7. With the growth of the city its parks have become more important. When the city was small, and the people could easily reach the open country, little need was felt for

parks. But when one must travel five or ten miles on street cars before reaching green fields and orchards, it is of great importance to have parks distributed conveniently in the heart of the city. Otherwise many children and even grown people will seldom if ever see grass and trees.

Central Park, about the middle of Manhattan Island, two and a half miles long and half a mile broad, is fortunately located for a large part of the residents. Much of it is a rocky ridge with great variety of hill and valley, stretches of meadow and woodland. Nearly half of it, four hundred acres, is in natural woods and planted groves. The provision for playgrounds is excellent; ten acres for ball ground for base-ball and cricket, plenty of swings for children; twenty acres of lake for boating in summer and skating in winter; the goat carriages for children's use; the north meadow, a grassy lawn of nineteen acres for tennis and picnic parties; small ponds and lakes of water lilies; ponds for sailing little boats, and the menagerie of wild animals. There are nine miles of beautiful carriage drives, and many miles of foot-paths and bridle-paths, among trees and bushes and over rocky hills and ledges. When we add to these the springing fountains, the broad terraces, and concert gardens, together with much statuary and architectural display, we have a model pleasure ground for the people. As many as one hundred and fifty thousand people visit the park on pleasant days, and in the course of the year about fifteen million persons enjoy the park.

This park was begun in 1857 and has cost the city in all more than $17,000,000, including about $300,000 a year for maintenance. But its present value is many times the cost. William Cullen Bryant was the first to ad-

vocate and encourage the laying out of a great park in this part of the city, and Washington Irving was a consulting member of the first park board. Eminent architects and landscape gardeners were employed in working out



Central Park, New York.

the plans of the park. Some of the finest specimens of statuary in the United States also ornament these grounds.

Parks are most needed in the thickly settled portions of the city where they can be easily reached by the children of the poor. More than a score of these smaller parks have been provided, and are scattered as breathing places over the crowded sections of the city. Such is Madison Square,

on Fifth Avenue, between 23d and 26th streets. It has seven acres of grass and flowers, shade trees and pleasant walks, and is much frequented by children with their nurses.

Other small parks are Union Square, Washington Square, City Hall Park, and a score of small open places where flowers and shrubbery and pleasant walks and seats can be enjoyed. Along the west side of Manhattan Island, from 72d Street north, is Riverside Park, stretching three miles along the rocky and wooded slopes which reach down to the river. A great driveway winding along the crests of the ridge furnishes many broad views of the Hudson and the Jersey shore. On the east side the park is lined with the palaces of wealthy New Yorkers, while at its northern limit it passes the massive tomb of General Grant, and crosses the grand viaduct, which spans the valley, toward Washington Heights on the north. This is probably one of the finest river drives in the world.

With the marvellous growth of New York City in the last one hundred years it has required an unusual wisdom and foresight to look ahead and anticipate the future needs of the city in the way of parks and pleasure grounds for the people. It is often necessary to purchase park lands far in advance, so as to preserve them for future use. Four of the small parks in lower New York (Union Square, Madison Square, Tompkins Square, Washington Square) were purchased by the city previous to 1847, and cost $353,331. They are now estimated to be worth at least $20,000,000. Central Park, which cost the city $17,000,000, is now worth many times this. A series of parks for the future benefit of the city has been purchased and laid out

on a grand scale north of Harlem River. It includes six parks and various broad, connecting parkways, in all about 3945 acres. Among these is Van Cortlandt, with 1132 acres of the old Van Cortlandt family. "The old family mansion is still preserved, a quaint Dutch building of stone, with terraced lawns commanding views of the Palisades and the Hudson River. There Washington had his headquarters while carrying on operations for the expulsion of the British from New York City." ("New York City," King.)

The Bronx Park of 661 acres, along the beautiful Bronx River, and Pelham Bay Park of 1756 acres, stretching north of the shore of Long Island Sound for nearly ten miles, are included in this spacious tract which is to be preserved for the recreation, games, and picnic grounds of the future millions of the greater New York.

Brooklyn also has its delightful pleasure resort in Prospect Park, with 516 acres valued at $27,000,000, besides many other larger and smaller pleasure grounds, parade grounds, and forests for the recreation of the people.

Other large cities, such as Pittsburg, Buffalo, Cleveland, and Cincinnati, have extensive parks where advantage is taken of natural forests, hills, and valleys to give a varied and beautiful scenery. Often these great parks are made still more beautiful by means of lakes and river views. Baltimore has two such large park preserves, besides many smaller ones. St. Louis was famous for the great park in which the World's Fair was recently held. Chicago has a series of extensive parks, two of which stretch for miles along the shore of Lake Michigan. Fairmount Park, Philadelphia, is laid out on a large scale along the Schuylkill River, and is one of the largest in the country.

Boston Common, of forty-eight acres in the centre of the city, is famous since before the days of the Revolution. In recent years Boston has formed plans for a great series of parks environing the city and covering many thousand acres of land.

The concentration of population in our large cities of late has greatly emphasized the need for extensive parks. As people become better educated they desire to escape from the smoke and turmoil of the city into the open country. On this account many thousands prefer to live in the suburbs, where there may be large yards and easy access to the country. But for the many thousands of the laboring classes and for the poor who cannot get away to the suburbs, or do not wish to, the city parks are indispensable.

For the still further relief of the crowded districts of New York City, recreation piers have been built out into the river. In 1892 the legislature passed a bill providing for the recreation and health of the people of New York by setting aside certain piers along the river front. The plan involves the construction of very large two-story pavilions on the pier ends, the lower stories being devoted to commercial purposes, and the high-arched upper rooms forming fresh-air gardens with music and flowers and sea views for the pleasure of the people. A number of these recreation piers have been built along the Hudson River and East River water front, and are much used in summer months. Public bathing places are also established along the water by the city authorities, and thousands of people make use of these baths.

For the relief of sick children and mothers during the

summer months, benevolent societies have established excursions to the country and to the seaside, where these charges are given a week's outing. The Children's Aid Society has a summer home at Bathbeach, Brooklyn, N. Y., where over four thousand tenement children are given a week's outing each year.

There are also many great amusement resorts like that of Coney Island on the south shore of Long Island, where hundreds of thousands of people from the city flock to get entertainment together with fresh air and sea baths. On holidays and Sundays the boats and trolley cars to Coney Island are crowded with these pleasure seekers.

Education

9. The educational institutions in New York City have tried to keep up with the growth of the city in other respects.

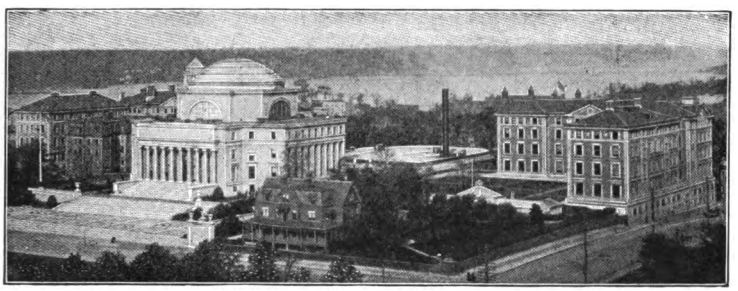
Of these the common schools are the most important, reaching to all classes of people.

The growth of population has been so rapid that it has been difficult to provide school buildings with sufficient seats for children. Although millions of dollars have been spent upon new school buildings, every autumn finds such an increase in the numbers of school children that many have been obliged to attend only half-day sessions.

Some of the ward schools of New York City are very large, with two thousand or more children.

The greatest single educational institution in New York City is Columbia University, located in the northern part of the city at Morningside Heights. It was founded before

the Revolution under the name of "King's College," and changed to "Columbia" after the war with England. Several men prominent in the Revolutionary days had been trained in King's College, as John Jay and Alexander Hamilton.



View of Columbia University.

In all its departments Columbia University has between three and four thousand students, and it consists of a group of colleges, such as the regular college department of Columbia, the law and medical schools, Barnard College (for women), and The Teachers College.

Columbia University completes the education begun in the common schools and high schools. In a city like New York there must be thousands of young men and women who wish to take a college course, and it is a great advantage if they can get their college training while living in their own homes. By means of the electric car lines, the elevated roads, and the subway (all passing near Columbia), students from all parts of Greater New York can easily reach the University.

Some of the most eminent professors in the United States are regular teachers at Columbia (all told, there are several hundred lecturers and instructors). It is a very wealthy institution, having property and endowments to the extent of about $20,000,000, and its yearly expenses are not far from a million. (In 1901 the whole budget of expenses was $814,329.)

The University is superbly located on Morningside Heights, with the Morningside Park on the slope of the steep hill to the east, and the Riverside Drive along the Hudson on the west. The most conspicuous building is the great library, the gift of Mr. Seth Low, recently Mayor of New York, after being President of Columbia. The Library building cost about one million dollars, and contains a large collection of books, which are at the service of teachers and students.

For the encouragement of ambitious young men who are not rich in money, numerous scholarships and fellowships are granted to those who are deserving. Some of these scholarships grant free tuition at the University, others furnish a money support during a year or more of study.

Barnard College, located just west of the main University, and named in honor of a former eminent president of Columbia, is a college for young ladies who wish to take a regular university course.

The University is not supported by public taxation, but by donations or endowments bestowed by wealthy business men. There are usually in a great city like New York a number of wealthy people who are willing to bestow a part of their riches upon great public institutions. Such a

university is also of immense value to the city, and to the whole country, by holding up before all young men high ideals of education and encouraging them by superior teachers and libraries to take advantage of such schools. Most of the leading men of the country are trained in the colleges and universities.

Another important school in New York of similar rank is the New York University. It has a commanding position on the heights above the Harlem River, not far from Columbia University.

At the head of the educational system of New York City proper is the College of the City of New York, which continues the High School courses into the field of college studies.

Brooklyn has also in Adelphi College a school of college rank.

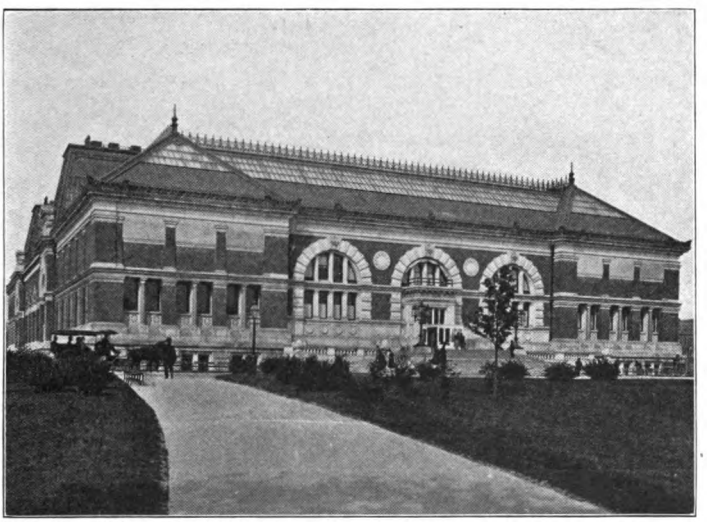
A number of famous theological schools of the various church denominations are located in or near New York City. Some of them are associated with the New York University and Columbia University.

Other large cities have found it necessary to establish and support great universities. The oldest and most famous of universities in this country is Harvard College, in Cambridge, adjoining Boston, and many of the most distinguished men in American history have been students or teachers there, as John Adams, Emerson, Lowell, Holmes, Sumner, Everett, and many others. Tulane University of New Orleans and the State University of California at Berkeley, near San Francisco, are great and influential schools in these places. The University of Chicago in recent years has taken rank among the great schools of

the world. Johns Hopkins of Baltimore has great distinction as a school of advanced learning. The University of Pennsylvania at Philadelphia, founded by Benjamin Franklin and others, is one of the largest schools in America. Minneapolis, St. Louis, Cincinnati, Cleveland, and many other cities are the seats of important universities. Many of the states, also, have established and supported large universities, often in smaller cities, as Madison, Wisconsin; Cornell University at Ithaca (only in part a state school); Ann Arbor, Michigan; Columbus, Ohio; Austin, Texas; Athens, Georgia, and many others.

The Metropolitan Museum on the east side of Central Park has been recently brought into close relation to Columbia University. This museum is a very important educational institution for all the people, though many do not understand its value. The building stands in Central Park and was provided at public expense, but the art treasures in the museum have been collected and presented by private persons. There are collections of beautiful paintings representing many of the famous masters and schools in Europe. There are casts also of famous statuary and important collections of art antiquities from Egypt, Greece, Babylon, Rome, and other countries. It is difficult for one who has not made a study of works of art to appreciate the value of these collections to students and artists, and to the people generally. Everywhere in the United States people are beginning to pay more attention to things of beauty, whether in buildings, in dress, in pottery, in statuary, in painting, or in metal work. The Metropolitan Museum contains the best collection of such works of art in the United States, and thoughtful people,

generally, take great pleasure in visiting and studying these objects. "Besides the advantages furnished to artists, artisans, and art students in copying and designing from its collections, the museum has kept up its art

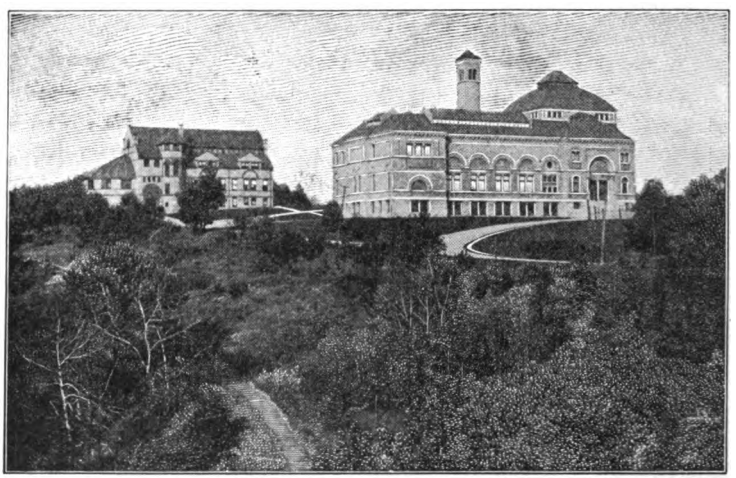


Art Museum, New York.

schools, in which the fine arts and decorative arts in their chief branches are taught, and lectures on art are given."

It is through such collections in museums that we may become acquainted with the finest art work of European countries. Artists and people of wealth have collected these treasures of art in Europe at large cost, and presented them to the Metropolitan Museum, where all Americans either directly or indirectly may get benefit from them. One reason why educated Americans travel

extensively in Europe is to find opportunity to visit the great museums of London, Berlin, Paris, Dresden, and the cities of Italy, where the world's greatest art products have been collected and preserved.



Art Building, Cincinnati.

The Metropolitan Museum is free to the public on five days in the week, including Sundays, and many thousands of people from all parts of the country visit it yearly.

Among the cities of America, Boston has made important collections of works of art. The Art Institute on Michigan Avenue, Chicago, has also a valuable collection of art works, which serves a purpose similar to that of the Metropolitan Museum of New York. In time, all of our large cities will make such collections, as they are an important part of the education of all the people.

The American Museum of Natural History is scarcely less important and interesting than the Art Museum and is much visited and used by school children in New York City.

The public libraries of New York are now one of the chief educational influences of the city. Three or four large libraries have been founded by wealthy men in New York at different times, — the Astor, the Tilden, the Lenox. These have been recently combined under one organization. In 1900 Mr. Andrew Carnegie offered the city a gift of more than $5,000,000 for the building of sixty branch libraries on condition of the city furnishing the building sites and a yearly tax of ten per cent of the gift for maintenance. These various gifts will put good, free public libraries within easy reach of all the people of Greater New York. Mr. Carnegie has established similar libraries in many smaller cities throughout the United States. They are designed to be used in connection with the public schools, and thus to be brought into as close relation as possible with other educational forces.

All the large cities in the United States have established libraries, often by the liberality of wealthy donors, often also by the public authorities and supported by public taxes. Such local libraries, where the best books and periodicals can be obtained free, are of untold value to the people, old and young, who desire to make progress in general knowledge or in special studies.

New York City is supplied with about twelve hundred churches, some of them the finest structures architecturally in the United States, *e.g.* St. Patrick's Cathedral on Fifth Avenue, and the Cathedral of St. John the Divine on

Morningside Heights, which is only partly built. Trinity Church is a famous old structure surrounded by the tall buildings on lower Broadway. The churches of New York are of all denominations, and many languages are spoken in their pulpits. Many famous clergymen also have preached from the pulpits of New York and Brooklyn, among them Henry Ward Beecher, Lyman Abbott, Bishop Potter, Parkhurst, and others.

A brief summary will suffice to show that there are powerful educational establishments in Greater New York, such as the public schools, the colleges and universities, the museums and libraries, and the churches which are influential on the side of education, culture, and religion, and are acting against the strong, evil influences in a great city.

To these better influences may be added the newspaper and periodical press. Not only in New York City, but far and wide over the whole country the great newspapers and monthly journals published here spread their influence. Some of the great newspaper editors like William Cullen Bryant, James Gordon Bennett, and Horace Greeley did their work in New York City.

Manufacturing in New York City

10. Some cities have special advantages for manufacturing one kind of product, as Pittsburg for iron, Lowell for cotton goods, and Louisville, tobacco. New York has special advantages for an immense variety of manufactures. The reasons may be briefly stated: (1) raw products of all sorts are brought into New York by ship and railway in any quantity; (2) many thousands of people are

glad to get work in the factories, and abundant capital of rich men is at hand to build and equip factories; (3) when goods are once produced, there are ready modes of shipment and distribution of manufactured products in all directions. The commerce of New York reaches the whole world, gathering in raw materials. After these materials are manufactured into higher and more valuable forms, they are shipped forth again to be sold in all markets.

We need not be surprised then to be told that some years ago New York alone, before the consolidation into Greater New York, had 12,000 factories and 500,000 operatives engaged in manufacturing a countless variety of goods. But in the neighboring cities of Brooklyn, Jersey City, Passaic, Newark, and many more, where there is much greater room for large manufacturing plants than on Manhattan, we must look for the largest plants. On Manhattan Island only those factories can be established which require little room and where a great many workmen may be engaged in limited spaces. This is especially true of tailors, seamstresses, and all kinds of garment makers. Thousands of immigrants from foreign lands are tailors by profession or soon become such in New York. The manufacture of clothing in its numerous forms leads all others. Many of the Russian Jews, who have come to New York in recent years, have taken up tailoring and allied industries, although this was not their occupation in Europe. Second on the list comes the making of books and papers. Many of the large publishing houses of the United States are located in New York, also great daily newspapers, and the printing and book-making establish-

ments are numerous. The manufacture of tobacco into cigars and other forms is a business that employs thousands. Pianos and musical instruments of many sorts are produced in abundance. Metal work and artistic work of many kinds are wrought by a great variety of expert workmen.

In Brooklyn and in the outlying cities are found some immense manufacturing plants. "The American Sugar Refining Company is the greatest manufacturing industry in the vicinity of New York City. No other local industry begins to compare in magnitude or in importance with that of sugar refining. The immense establishments of the American Sugar Refinery are scattered along the water front of Brooklyn from Wallabout to Newtown Creek." One establishment (the Havemeyer and Brooklyn houses) produces 14,000 barrels a day. The sugar refineries of this company in Brooklyn have a total capacity of from 22,000 to 25,000 barrels of sugar per day, more than half of the entire demand for the United States.

"The collateral industries supported by these refineries alone are vast and varied. Immense cooperages are kept busy supplying the 9,000,000 or more of sugar barrels they require each year. Hundreds of trucks are necessary to transport daily their product to the various railroad freight stations. The supply of animal charcoal for filtering purposes is drawn from all over the country, and amounts to 20,000,000 pounds per annum. The consumption of coal is over 400,000 tons for the same period. To handle the immense output of these houses all the great trunk line railways of the country have been obliged to establish receiving stations and terminal depots in Brooklyn. An army of nearly 4000 men is required to operate the refin-

eries and their tributaries. The raw sugar used in the process of refining, coming from every quarter of the globe, amounts to nearly 2,000,000,000 pounds per annum, and the ships of all nations can be seen discharging their cargoes day and night at the immense docks and warehouses of the refineries. The capital involved in carrying on this immense industry is $75,000,000." (King's "New York City.")

This is merely an illustration of scores of great manufacturing establishments. Others are for the making of clocks, electrical machinery, ink, biscuits, drills and mining machinery, pianos, elevators, machine belting, iron and tinware, glue, hardware, bridge material, wall paper, printing presses, typewriters, curing and smoking of meats, and a thousand others.

Nearly all great manufacturing companies in all parts of the United States have offices in New York, so that one can do business directly with all the great firms by simply going to New York City.

What is thus described as peculiar to New York in manufacturing is found to be true in a less degree of Chicago and Boston and other cities. On account of the immense accumulation of raw products, and of people in Chicago, it has grown of late years to be one of the great manufacturing cities. Boston, of all New England, would be expected to illustrate the development of manufactures. Minneapolis, Detroit, San Francisco, Buffalo, and all large cities naturally become manufacturing cities. Buffalo promises, on account of the water power now developing at Niagara, to become the chief centre of manufactures in the country.

Financial Centre of the United States

11. On account of this preëminence of New York City in commerce, in population, in manufactures, in wholesale and retail trade, in banking, and in all other great lines of industry, it is often spoken of as the *financial centre* of the United States. The great banks, trust companies, insurance companies, and railroad and mining companies centre their affairs in New York City.

How the leading money transactions centre in New York may be seen from the following: The money payments for the imports and exports of the United States are made chiefly at New York City. The customs duties, in a large part, are paid there, and deposited in the United States Sub Treasury. The large railroad systems of the United States are chiefly owned and managed by New York capitalists, and many of their headquarters are in New York City. A number of the largest insurance and trust companies which handle and loan hundreds of millions of capital have their great central office buildings in New York. The banks and central clearing house, where the greatest financial transactions of the country are made, are in the lower part of New York. The United States Subtreasury "conducts fully two-thirds of the direct money dealings of the government with the people. . . . It receives the money paid into the New York Customs House, as well as from postmasters and other government officials. The interest on the government debt is paid in checks drawn upon it, together with about three-fifths of all the money disbursed to pensioners and government payments of all kinds." Its transactions each year run up into the billions of dollars.

Where great enterprises have been undertaken, like the building of the Pacific Railroad, large loans made to the government in time of war, the Panama Canal, the New York Subway, it is the New York bankers who usually supply the financial resources. The wealthiest men from all parts of the United States are inclined to make their headquarters and even their homes in New York.

In many of the most important matters New York is seen from the above description to stand foremost among American cities. And yet in two important particulars New York is surpassed by other American cities. Boston and Philadelphia are richer in historical associations and in the memorials of great events in American history.

Old Independence Hall in Philadelphia, in connection with the events of the Revolution, will long remain the chief landmark in our history. Faneuil Hall, the Old South Church, and Bunker Hill in Boston are almost equally prominent in Revolutionary events. Boston, also, in connection with Harvard University, has always kept the lead in education and culture. To the visitor who seeks interesting and noteworthy objects of study, Boston probably furnishes as many as if not more than New York.

New York City also has a very attractive and valuable history in connection with Hudson and the early Dutch settlers. Some of the old manor houses of the Dutch patroons, like that of Van Cortlandt's, still survive. The battles of Long Island and of New York, during the Revolution, and some of the old forts, the inauguration of Washington, and many great events and celebrations in our history are associated with New York. In recent

years greater interest has been taken in preserving historical memorials.

There are many interesting monuments and statues in the parks and public places of New York, like the Washington Arch, Grant's Tomb, Cleopatra's Needle, the Statue of Liberty in the harbor, the statues of famous men, as Horace Greeley, Columbus, Benjamin Franklin, Washington, Nathan Hale, and many more.

It would be interesting to compare the conspicuous men who have been associated with our chief cities, as Samuel Adams, Emerson, and Phillips Brooks with Boston; Washington Irving, Hamilton, Greeley, Robert Fulton, and Henry Ward Beecher with New York; William Penn, Benjamin Franklin, and Robert Morris with Philadelphia.

There are other cities of the United States which have very interesting historical associations, as Charleston, New Orleans, Nashville, San Antonio, San Francisco, and St. Louis. Detroit and Pittsburg are especially connected with the romance of the pioneer period.

A happy custom is now growing up in the United States of making much of these local historical places of interest, of building monuments, and preserving relics and memorials of these early events of our history.

Washington is a city which differs from all other large cities in the United States in its origin and importance, and requires a separate treatment.

WASHINGTON

Washington, unlike New York or San Francisco and other large American cities, was not located by commercial

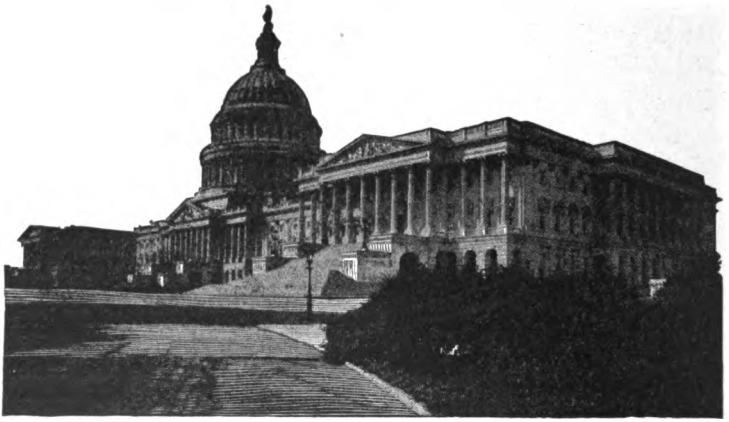
needs, but was chosen by George Washington, at the suggestion of Congress, as the seat of government for the United States.

The corner-stone of the Capitol building was laid by George Washington in 1793. The great wings of the building in which the Senate and House of Representatives now meet were not begun till 1851. This best-known and most imposing building in the United States stands on the brow of a sloping hill ninety-seven feet above the level of the Potomac. It is a conspicuous object in a noble landscape whose hills stretch along the Potomac.

One and a third miles away, on the lower plain nearer the Potomac, stands the lofty shaft of the Washington Monument, a plain and simple obelisk of white marble rising 555½ feet, the tallest stone structure in the world. From its summit one may clearly see the mountains to the west, but it towers far above all objects in and near the city. The Capitol and Monument fitly celebrate the fame of Washington. In this city one is reminded in many ways of the first President. In the White House his portrait is conspicuous. In the national buildings and in nearly all public places one sees reminders, — statues, pictures, and mementos of the founder of the city. Only a few miles down the river is his home, Mt. Vernon, reached by a delightful steamboat ride upon the broad Potomac. No city ever had a nobler founder. The government of a great country centres also in this city, and Washington was also the commanding figure when this new government started on its course.

The city was originally planned on a grand scale, and

because of its widely scattered parts while still young was once called "the city of magnificent distances." But it has grown wonderfully in recent years and filled up the broad spaces. With numerous vast public buildings, with many miles of smooth asphalt pavement, with streets of imposing private residences, Washington has become a beautiful city with which Americans are delighted.



National Capitol, Washington.

The Capitol building is for the United States as a whole what the state Capitol is for each of the separate states, — a centre for the law-making industry. The laws made by the Senate of the United States and the House of Representatives, when approved by the President, have full force in all the many states and territories, and even in Alaska, Hawaii, and the Philippines. This great building shelters men of every state of the Union, from Florida to Puget Sound, and from Maine to Texas and California. When

they sit down in the two wings of the Capitol building to make laws, it is as if all the people of the United States were together in one assembly. For these men make laws for all parts of the country alike. In this big building are brought together, therefore, people who stand for the important interests of all parts of our land.

The other large public buildings in Washington have been built by the whole nation for the benefit of the whole nation. The Treasury building, for example, is the place where the money used in all parts of the United States is largely made and sent out. Connected with the Treasury building is the Bureau of Printing and Engraving, and together they manufacture all our paper money, put it in circulation, and receive back the old worn-out bills which they redeem and then destroy. A million dollars of new money is each day sent out by the Treasury Department to banks all over the United States, and then put in circulation. A corresponding number of old and tattered bills is returned and after being carefully examined and tested are put into a great machine (macerator) and ground to pulp. The gold reserve of $100,000,000 is kept in the Treasury vaults here and in the subtreasuries at New York and elsewhere. Silver coins and fractional currency are also piled up in these vaults.

The Treasury building is of large extent, 450 feet by 250 feet, and stands just east of the White House. Fourteen hundred employees are required to handle and care for this money. A military guard is on hand, and a larger force can be almost instantly summoned if needed to protect the wealth of the Treasury.

The Secretary of the Treasury, who has charge of the

business of the Treasury building and of the financial operations of the government, is a member of the President's cabinet. His business is to deal chiefly with banks all over the United States, to furnish them with money, and in the case of national banks to send out bank examiners to visit and examine accounts.

The Post-Office Department also has a large building on Pennsylvania Avenue, and the Postmaster General has in a broad sense the management of all the post-offices and postmasters in the United States. In connection with the post-office business, it can be seen that the government reaches into every city and village, and even to every home in the United States.

Just west of the White House is a magnificent office building, called the State, War, and Navy building. "It has five hundred rooms and two miles of marble halls. The stairways are of granite, with balusters of bronze, and the entire construction is fire-proof; for the records and archives deposited within its walls are priceless and beyond restoration." Each of these departments occupies one whole wing of this building.

The Secretary of State, whose office is in the south wing, deals with those matters which are of interest to the United States in foreign countries and in all parts of the world. The United States has in all large cities of other lands, as in Calcutta, in Naples, in Liverpool, in Rio Janeiro, in Tokio, American consuls, who are sent out to look after the trade and other interests of Americans in those cities. The American government pays the salaries of these men, and calls for regular reports from them. In the capital cities of all countries, the United States has also ambassa-

dors who are sent there to keep up a friendly acquaintance with rulers and governments everywhere, to manage and settle all disputes that arise between the United States and those countries, and to aid American travellers and merchants in those lands. The Department of State, therefore, needs to keep itself well acquainted with all important matters that are going on all over the world, and to be ready to act and to advise the President what to do in a great many important questions.

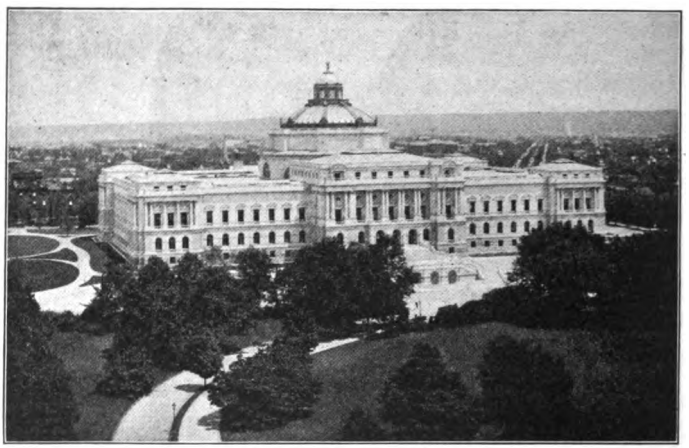
Even in time of peace the Army and Navy departments must keep up the strength and efficiency of the sailors, soldiers, forts, and ships belonging to the United States in all the military and naval stations.

There are several other great departments of our government at Washington, which are presided over by cabinet officers. Among other things they deal with agriculture, legal business, commerce, education, the payment of pensions to old soldiers, schemes for irrigating dry lands in the West, the regulation of railroads, the care of lighthouses and life-saving stations on the coast of lakes and oceans, the preservation of forests, the protection of fisheries in rivers, lakes, and oceans, the punishment of criminals and law breakers, and many others equally important.

The number of people engaged in government work at Washington and all over the United States, under the direct supervision of officials at Washington, runs up into the hundred thousands. The city of Washington is the chief centre for government business, just as New York City is the leading commercial and manufacturing centre. More than any other city of the United States, Washington

deals with all the people of the country and with their important interests.

On account of the number of distinguished men, such as the President and cabinet officials, the judges of the Supreme Court and their families, United States senators



Congressional Library.

and congressmen, Washington has become the most important social centre of the United States. The foreign diplomats and their families add to the distinction of Washington society. Every state capital on a small scale builds up a governmental and social centre similar to that at Washington.

In addition to the large government buildings and national business departments already described, Washington is notable for several additional important objects of study. One of these is the Congressional Library. It is a pity that

not all children in American schools are able to visit this building, which is probably the most beautiful structure in America. Its interior decorations are so tasteful and instructive that a well-educated person might spend an hour a day for weeks showing children its walls, its mural paintings, its busts and portraits of eminent poets, philosophers, musicians, painters, inventors, and educators, its brilliant marble columns, and its tiled floors. The central hall of entrance with its grand stairway has been called "a vision in stone." It would be worth travelling a long distance merely to spend a day or more in this marvellous building. The great rotunda or reading room is imposing and beautiful in harmony of colors.

The building itself, ornamented, in its magnificent halls and corridors and in the circuit of its great rotunda, with the names, statues, sayings, and mementos of wise peoples in all ages and nations, is the appropriate home of a vast library.

"Any one may use the library, but books may be drawn out only by members of Congress, the President, Supreme Court, and government officials. The book stacks devised by Mr. Bernard R. Green consist of a series of cast-iron frameworks, supporting tiers of shelves, and rising in nine stories to the roof. Each of the two large stacks has a capacity of 800,000 volumes, the smaller stack 100,000 books. The book shelving now in the building will accommodate 2,085,120 volumes of books, reckoning nine to the foot. The capacity of the additional shelving which may be placed is about 2,500,000 volumes, and the ultimate capacity of the building for books is upward of 4,500,000 volumes." ("Standard Guide.") More than 1,000,000

volumes are now in the library. The copyright system of the United States requires that two volumes of each copyrighted book be placed in this library.

The descriptions and pictures in a standard guide book of Washington will assist greatly in forming an estimate of this and other buildings in Washington.

The Smithsonian Institution and National Museum, founded in 1846 by the gift of $515,000 by James Smithson, "for the increase and diffusion of knowledge among men," has grown to great importance. It is designed to encourage learned study and investigation, and publishes important reports and contributions to knowledge. The museum supported by Congress has become a vast collection of five million specimens, such as historical relics, geological collections, natural history specimens, race antiquities, implements and inventions, etc. These collections are of interest to all people as curiosities, but to students and scholars in all departments of knowledge they are of fundamental value.

Another very important building is the "Corcoran Art Gallery," which was founded by the gift of Mr. W. W. Corcoran, "for the perpetual establishment and encouragement of the fine arts." Mr. Corcoran must have felt that Washington was the best place in the United States for founding a museum of fine arts. A considerable collection of statuary and of paintings has already given a high repute to this temple of fine arts. It seems strange that our government has done so little for the encouragement of fine art as illustrated in this museum. The capital cities of Europe have been, through their governments, munificently supplied with the world's best works of art, in

sculpture, architecture, paintings, etc., and it is regarded as a work of the highest wisdom and culture to appreciate and encourage such products. But our government has not yet appreciated fully the value of these supreme products, first as a sign of refinement, and second as an educative influence upon the people.

The Corcoran building, both without and within, is a fine specimen of architecture, and a fitting storehouse for such treasures. The Metropolitan Museum in New York, the Art Institute in Chicago, are proofs that our great cities are beginning to appreciate the value of museums of fine art.

The Halls of the Ancients, which have had a beginning in Washington, are an additional effort to exhibit the art, architecture, religion, and life of the ancient nations.

The purpose of the foregoing discussion of American cities is to use New York City as an eminent type of modern city problems, and to suggest a method of comparison by which many cities may be made to contribute their share to the understanding of these problems. It would be possible for any teacher to extend these comparisons so as to involve an interesting review of all important American cities. This would also constitute an excellent preparation for the study of European cities.

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